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2011 MOURNING DOVE
POPULATION AND RESEARCH
STATUS REPORT

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Migratory Bird Harvest Information Program (HIP)

The national migratory bird harvest information program (HIP) was developed to fill the need for reliable harvest data to guide management decisions for all migratory game birds in addition to numerous post-season mail harvest surveys conducted by individual states. Although federal waterfowl harvest surveys existed since 1952, historical surveys lacked a reliable sampling frame of names and addresses of all migratory bird hunters and, therefore, did not adequately address webless migratory game birds (e.g., mourning doves, woodcock). Since 1998, the HIP harvest survey has provided reliable estimates of hunter activity and harvest at national and regional scales for all migratory game bird species, and provides comparable harvest estimates at the state scale.

During the 2010-11 mourning dove season, as estimated by the HIP survey, Texas led the Central Management Unit (CMU; Figure 1) in mourning dove harvest with 4.7 million birds killed by 244,600 dove hunters (Table 1). During 2010-11, Missouri was fourth in CMU mourning dove harvest with 426,000 doves killed by 29,300 dove hunters; Kansas was second, Arkansas was third, and Nebraska was fifth in harvest (Table 1).

Missouri's Small Game Post-season Harvest Survey

Starting in 2009, information from the Small Game Post-season Harvest survey was determined to be necessary on an every-other year basis; 2010 results are presented below.

Harvest data for Missouri during 2010 showed 34,746 mourning dove hunters harvested 492,696 doves statewide; a 6.0% increase in hunters and a 4.6% decrease in harvest from 2008. Statewide, dove hunters averaged 3.9 doves per day and 3.7 days of hunting per season in 2010 compared to 4.1 doves per day and 3.9 days per season in 2008. Average season bag for 2010 was 14.2 mourning doves compared to 15.8 in 2008. Data for 2010, by zoogeographic region, showed Mississippi Lowlands and Northeastern Riverbreaks with the largest harvests (123,868 and 95,365 doves respectively) and Northern Riverbreaks the lowest (12,089 doves; Figure 2a).

Long-term trends of harvest and hunters continue to show relatively long-term declines (Figure 3), with daily bag and average days afield staying relatively stable the last few years (Figure 4).

Although the number of hunters and harvested doves has declined since the 1970s, remaining dove hunters are hunting about the same number days, while gradually increasing their daily harvest.

2011 MOURNING DOVE POPULATIONS TRENDS/SURVEYS

The Department annually conducts two mourning dove surveys in Missouri, the National Mourning Dove Call-Count Survey (CCS) and the Roadside Dove Survey (RDS). The CCS is a national survey conducted annually in cooperation with the states and the USFWS. The CCS was established in 1966, and currently surveys nearly 1,500 routes nationally. The CCS was established to provide regional and national population indices. In Missouri, the CCS provides an index of doves heard calling per mile along 20 standard routes. In addition to the CCS, the RDS is an independent survey conducted annually by Department staff; the survey contains usable data going back to 1948. The RDS provides an index of doves seen, rather than calling, along standardized routes throughout the state (some urban counties have been excluded through time because of traffic concerns). The RDS provides regional data for Missouri that the CCS cannot supply. There is very strong long-term relationship between both surveys over several decades; however, it is not unusual for the two surveys to show relatively small opposite trends within a given year; e.g., this past spring.

2011 National Mourning Dove Call-Count Survey

For Missouri, CCS log-linear hierarchical model fit using Bayesian methods between 2010 and 2011 showed inconclusive evidence about a trend in abundance of a 4.9% decrease (95% CI: -21.3% to 12.1%; Figure 5). During the last 10-years (2002–2011), Missouri's CCS trend showed inconclusive evidence about a trend in abundance of a 1.6 % decrease (95% CI: -3.4% to 0.7%) per year. Long-term CCS trends for Missouri (1966–2011) continued to show evidence of a trend decline of 2.4% (95% CI -3.1 to -1.7%) per year. Throughout the 14 Central Management Unit (CMU; Figure 1) states, 2011 dove populations showed evidence of a trend decline of 5.9% (95% CI: -10.6% to -0.7%) compared to 2010 indices. The relative trend of doves heard calling and trend of doves seen while conducting CCS routes in the CMU show different trajectories (Figure 6) lending suspicion to the value of the data in a harvest management decision-making process. This is one of the reasons why the interim mourning dove harvest management strategy and the evolving long-term harvest strategy will be based on vital rates derived from banding, harvest, and wing collection data.

2011 Missouri’s Roadside Mourning Dove Survey

Statewide results of the 2011 RDS showed 1.24 doves/mile; a 4.75% increase compared to 2010 (Figure 5), a 9.43% decrease from the statewide 5-year average (2006-10; 1.37 doves/mile, SD 0.16), and a 7.16% decrease from the statewide 10-year average (2001-10; 1.33 doves/mile, SD 0.12; Table 2). By zoogeographic regions (Figure 2a), Mississippi Lowlands had the highest index (2.59 doves/mile), and the North and Eastern Riverbreaks and Ozark Plateau the lowest (1.06 and 0.59 doves/mile respectively; Table 2). Survey results are also provided by Department management regions (Figure 2b; Table 2).

This year, both the CCS index and RDS index showed relatively small changes from the previous years as well as declines in 5-year and 10-year averages (Figure 5; Table 2), indicating stable to slightly smaller population levels. Depending upon weather conditions the last week of August and early September and food availability to concentrate doves, hunting opportunities are anticipated to be good to slightly below average.

Long-Term Population Trends
Long-term mourning dove trends from both RDS and CCS surveys provide an interesting picture (Figure 5). Since 1966, both surveys show a strong relationship to each other (r = 0.79; 1966-2011). If we assume that these 2 surveys are tracking similar aspects of the mourning dove population, we see 3 things emerging from Figure 5. First, although trends have declined since 1966, the RDS trend has been relatively stable in the last 10 years. Second, although trends are lower today than during the late 1960s, RDS trends are near levels similar to the late 1940s and early 1950s. Third, some phenomena occurred during the late 1950s and early 1960s that caused trends to climb rapidly. Regionally, we can speculate that some beneficial and broad scale land use changes occurred in the Mississippi Lowlands, Northeast Riverbreaks, Northeastern Riverbreaks, and Western Prairie during the late 1950s and early 1960s (Figures 18–25). Regardless, the important point is that roadside trends are problematic at best when trends of similar variables contradict each other (Figure 6). Also, trends in such data change with no apparent explanation for the change.

From a national perspective, some uncertainty exists about the relative merits of the North American Breeding Bird Survey (BBS) and CCS surveys (i.e., CCS doves heard, and CCS doves seen), and the actual ability of the surveys to track real changes in mourning dove population trends. Although the CCS protocol is specifically designed for doves, the number of survey routes is less compared to the BBS, which leads to concerns about the sensitivity of the survey to detect trends. In addition, these trend declines may not be indicative of actual changes in populations, but rather an index to unmated males in the breeding population, changes in habitat along standardized survey routes, or a wide range of other factors. Although uncertain in some respects, these data provide a useful and generalized picture of relative population trends for use in providing regional and statewide hunting forecasts for Missouri. These uncertain data, however, show the need for improving the reliability of the information used in the harvest management decision making process (i.e., establishing and changing hunting regulations). This was the primary motivation for the establishment and approval of the Mourning Dove National Harvest Management Plan adopted by all flyway councils and the Association of Fish and Wildlife Agencies, and the emerging and ongoing national mourning dove banding and wing collection programs.

INTERIM MOURNING DOVE HARVEST MANAGEMENT STRATEGY FOR THE CENTRAL MANAGEMENT UNIT AND IMPACTS ON THE 2011 MOURNING DOVE HUNTING SEASON REGULATIONS

The hunting regulation for the 2011 mourning dove hunting season in Missouri is 15 birds per day during a 70–day season. Following is the rationale for the season structure and how the regulation decision is made.

As mentioned earlier, the future of dove management depends primarily upon harvest management and our understanding of how harvest affects dove populations. In other words, our primary explicit assumption is that doves are habitat generalists and that we believe changes at the macro-habitat level has minimal impact on abundance. Increasingly, there has been broad-scale support for improving the information used in the decision making process for mourning dove harvest management. In 2001, a National Mourning Dove Planning Committee was formed and developed a plan of action that would lead to guidelines that technical committees could use to prepare harvest management plans for their respective management units. The National Plan was approved by all 4 flyway councils in August, 2003. The plan outlined a new vision of information-based decision making compared to the status quo of singly relying on population trends from roadside indices. The USFWS Regulations Committee (SRC), however, requested the respective management unit technical committees develop an interim mourning dove harvest management strategy given available information (e.g., BBS and CCS indices). This request was based upon a perceived idea that the recently approved National Plan, although a step in the right direction, would not provide useful assistance in the harvest regulation process for several years.

The revised interim harvest management strategy provides guidelines for cooperative establishment of mourning dove hunting regulations in the Central Management Unit (CMU; Figure 2). This revised strategy is a transitional step towards implementation of the strategy envisioned in the **Mourning Dove National Strategic Harvest Management Plan**, and provides recourse in the event of large year-to-year changes in the mourning dove population. The composite trend models used as the basis of the strategy will be replaced by population models in ≤5-years, pending continued and expanded support for banding and wing survey programs, and research generating information for population models. This interim strategy, and subsequent strategies using population models, will fulfill requests by the USFWS for mourning dove harvest management strategies that use similar sources of data among dove management units.

The interim strategy presumes that regulatory decisions will be made based solely on composite population trends during a specified time frame. The composite trends will be estimated from four data streams: CCS-heard, CCS-seen, BBS, and population growth rates derived from banding and harvest data. It is assumed that there are 3 regulatory alternatives, which are generically referred to as: 1) restrictive, 2) enhanced, and 3) standard. The simple idea is that if the composite trend is at or below some pre-determined lower threshold value with some specified level of statistical confidence, then regulations would be restricted. If the trend is at or above an upper threshold value with some specified level of statistical confidence, then regulations are liberalized. Current regulations will be maintained as moderate or standard packages if the trend is between the 2 thresholds. It is important to note that while these composite trends provide a decision making framework in the **interim**, they are largely uninformative to processes governing dove populations. That is, **the composite trend indices do not inform managers as to why the trend goes up or down, or the effects that harvest regulations have on population vital rates**.

Implementation of a decision framework requires specification of 6 parameters:

- time interval to generate indices,
- annual rate of change during the selected time interval that will trigger a liberalized harvest regulation (L),
- probability (P_L) that the trend estimate (T) is equal to or greater than L in the posterior probability distribution,
- annual rate of change during the selected time period that will trigger a restricted harvest regulation (R),
- probability (P_R) that the trend estimate (T) is less than or equal to R in the posterior probability distribution, and
- the number of years the regulatory package remains in place.

These criteria provide the flexibility to implement a wide spectrum of regulatory options accommodating a wide range of considerations. Following is a matrix showing the decision outcomes in the harvest regulation decision-making process. Simply stated, if the composite 5-year trend is significantly increasing we can anticipate a 22-bird daily bag with a 70-day season. If the trend is stable we would likely have a 15-bird daily bag with 70-days. If the trend is declining we would have an 8-bird daily bag. Regulations remain in effect for 3-years if a change occurs to evaluate impacts of the change; data analysis of trends occurs annually. Using data from 1980–2006 to determine if regulatory changes would have occurred in the past, we found that no regulation changes would have occurred based on the performance of the composite trend estimator.

Composite Population Trend	Estimated annual rate of change during a 5-yr interval	Proportion of Estimated Trend	CMU Daily Bag Limit
$t > 0.00$ (increasing trend	$\hat{t}_L > 0.05$	$P_L \geq 0.80$	22 (**enhanced**: 47% increase in bag limit, and an estimated 24% harvest increase)
$t = 0.00$ (stable trend)	$\hat{t}$ is between -0.05 and 0.05	--	15 (**standard**: no change in bag limit)
$t < 0.00$ (declining trend)	$\hat{t}_R < 0.05$	$P_R \geq 0.80$	8 (**restrictive**: 47% reduction in bag limit, and an estimated 24% harvest reduction

MONITORING DOVE SHOOTING FIELD MANAGEMENT

Mourning doves provide abundant hunting opportunities close to where urban residents live. Unlike other game animals that require relatively large areas of habitat management for hunting, mourning dove shooting field management routinely occurs on sunflower fields ranging in size from 5–30 acres. However, considerable uncertainty has existed concerning harvest management strategies; e.g., half day vs. all day hunting, large daily harvests in relatively short periods vs. small daily harvests spread out over a longer interval.

To address this range of management questions, biologists from several conservation areas with active dove shooting management programs met in July, 1999 to develop a long-term Adaptive Resource Management (ARM) effort; the program was expanded to include additional areas in 2003. The ARM process works best with management problems such as this one because the problem is small enough to explicitly define a management objective, and develop a meaningful and efficient monitoring program. Thus, the overall goal of the ARM program is to learn how different dove management strategies impact our objective of maximizing dove hunting opportunities on public areas. As a part of the monitoring program, dove hunters on these areas are required to report the number of doves killed, shots fired, hours hunted, zip code (to obtain an estimate of distance traveled to hunt), and number of doves shot but not retrieved; an orange-colored daily hunting card is used by dove hunters on these areas to help collect the necessary monitoring information.

To monitor our success in meeting our objective, we are collecting information on various harvest related metrics (Tables 3–6; Figures 7–15). For example, 77.3% of dove hunters went hunting once during September 2010, 14.9% went twice, and 4.8% went three times (Table 5). Average data during 1998–2009 showed considerable variation among participating areas (Figure 7) for number of hunts (or hunters; Figure 8), hours hunted (Figure 9), shots fired (Figure 10), and doves harvested (Figure 11). During 1998–2009, most dove hunting trips and harvest occurred during the first 7-days of the season (Figures 12 and 13), and harvest rates were generally highest during opening day of the hunting season (Figure 14). Also, most dove hunters traveled a median distance of 6.0–48.9 miles to hunt doves (Table 6).

Some areas in the experimental monitoring program have a nontoxic-shot regulation (Columbia Bottom CA, Eagle Bluffs CA, Otter Slough CA, and Ten-Mile Pond CA), and other areas have no shot-type regulation (August Busch CA, Bois D'Arc CA, Pony Express CA, Reed Memorial Wildlife Area, and Talbot CA). During 2005–2009, there were more shots fired per hunter on the nontoxic-shot areas shot compared to areas with no shot-type regulation (Figure 15a). Some stakeholders may suggest that these data show that nontoxic-shot is less effective or has lower lethality compared to traditional Pb shot because more shots were used per hunter. Hunters kill more doves per shots fired, however, on the nontoxic-shot areas compared to the areas with no shot-type regulation (Figure 15b). These data suggest that dove hunters apparently are not afraid to shoot more rounds of nontoxic-shot ammunition (regardless of cost differences among ammunition types) on areas with a nontoxic-shot regulation, and that areas with a nontoxic-shot regulation may have more birds available for harvest possibly because fewer birds have ingested Pb pellets and succumb to Pb poisoning.

Factors Affecting Mourning Dove Harvest in Missouri

Considerable interest in issues related to local, intensive managed dove hunting areas continues among managers and administrators. Using information from our long-term monitoring program, our objective was to evaluate effects of different local management strategies, including field management and regulations, and weather on the number of hunts and the number of doves harvested annually. We collected harvest information from dove hunters, and area management characteristics from wildlife managers on 9 public hunting areas in Missouri from 2005–2009 (Figure 16). Number of hunts on an area was best explained by number of hectares of crop on the area; however, acreage above 50 ha offered limited increases in the number of hunts on a site (Figure 17). The most supported model for the number of doves harvested contained a positive effect of acreage of sunflowers in good or excellent condition. This model was followed by a closely competing model reflecting increases in the number of doves harvested when an area used daily lottery and shot-type restrictions; however, complete overlap between these 2 regulations prevented separation of their individual effects. To manipulate hunting opportunities and harvest levels in Missouri, managers can be most effective by controlling hectares and condition of managed croplands, especially sunflowers. However, further work is needed to assess the relative impacts of lottery regulations and nontoxic-shot restrictions on dove harvest. **(Full details available in Wildlife Society Bulletin; 2011, 35:76–84)**

It is important to note that the few areas involved in this long-term monitoring program represent just a few of the numerous mourning dove hunting opportunities on public areas found in Missouri. The Department provides managed mourning dove hunting opportunities on approximately 5,000 acres located on 150 fields located on over 90 public conservation areas scattered around the state. Check the public web sometime after the middle of August to locate the managed areas near you (http://www.mdc.mo.gov/).

MOURNING DOVE RESEARCH UPDATE

National Pilot Banding Study

To improve future harvest management decisions at the national, regional, and statewide levels, population information is needed to make better informed decisions. Interim harvest management strategies have been approved using existing historical data to help make more informed harvest management decisions. Also, the national mourning dove banding program continues to obtain modern information on band reporting rates and harvest rates for use in the population models, which in turn will be used in making decisions about future changes in hunting regulations and harvest management strategies. To date, these efforts have received widespread support (e.g., flyway technical committees, flyway councils, joint flyway councils, and the AFWA subcommittees and its working groups).

Missouri is banding doves on 16 areas, and attaching bands to 2,500–3,200 birds annually. During 2003–2010, the number of mourning doves banded in Missouri ranged from 1,899 in 2005 to 3,170 in 2010, and total of 20,401 doves banded (Table 7). During 2003–2010, the number of all recoveries from doves banded in Missouri ranged from 203 in 2010 to 355 in 2008; during the same period there were 2,311 (11.3%) recoveries resulting from doves banded in Missouri. Of those recoveries, 2,142 (92.7%) were recovered in Missouri (Table 7). In addition to being recovered in Missouri, doves banded in Missouri were recovered in 16 other states plus Mexico. For doves recovered in Missouri, most (97.4%) were banded in Missouri; the remaining recoveries were banded in 15 other states (Table 8). Graphical representations of band recoveries are provided (Figure 21).

Hunters that shoot and retrieve banded birds are asked to call **1-800-327-BAND (2263)** or report the band online (http://www.reportband.gov/). Hunters will be asked by the operator to provide the band number, the location where the bird was killed, and the date when the bird was killed. By reporting band numbers dove hunters will be helping to manage our dove resource for future generations.

Wing Survey and Recruitment

The National Dove Plan recognizes the need for mourning dove recruitment information. Recruitment indices for other migratory game birds are obtained from wing collections conducted by national mail surveys conducted by the USFWS. A 3-year study, therefore, was initiated in 2007 to collect samples of wings using the 2 different collection methods, compare state-level and management unit-level estimates of age ratios derived from the 2 methods, and provide a cost comparison. The results of this project demonstrated that the national mail survey provided an efficient and cost effective survey of dove wings. Other work has been accomplished at Iowa State University to correct for unknown aged wings. The national survey has now become operational and all of the wings (approx. 50,000) are processed and scored annually at the central location of the James A. Reed Memorial Wildlife Area, near Kansas City, MO.

Sampling wings from check stations at Missouri managed dove hunting areas will continue in an effort to obtain estimates of statewide recruitment. In combination with banding data, age ratios from dove wings can be used to estimate recruitment on a more realistic basis compared to the traditional fashion of using corrected age-ratios from wings and assuming that adult males and females are equally abundant in the population. Long-term datasets are necessary for the estimators to work properly; we currently have approximately 5-6 years of data. This preliminary work will eventually lead to a peer-reviewed manuscript and recruitment estimates that will be used in a balance-equation population model for a more informed harvest management strategy.

Mourning Doves and Lead (Pb) Poisoning Research

Potential Hazard to Human Health from Exposure to Fragments of Lead Bullets and Shot in the Tissues of Game Animals

Abstract: Lead is highly toxic to animals, however, humans eating game killed with lead ammunition have considered this exposure path of limited importance. Recent evidence illustrates that lead bullets fragment on impact, leaving small lead particles widely distributed in the meat of game tissues. This research addressed whether lead gunshot pellets also fragment upon impact, and whether lead derived from spent gunshot and bullets in the tissues of game animals could pose a threat to human health. Wild-shot gamebirds (6 species) obtained in the UK were X-rayed to determine the number of shot and shot fragments present, and cooked using typical methods. Shot were then removed to simulate realistic practice before consumption, and lead concentrations determined. Gamebirds containing ≥5 shot had high tissue lead concentrations, but some with fewer or no shot also had high lead concentrations, confirming X-ray results indicating that small lead fragments remain in the flesh of birds even when the shot exits the body. A high proportion of samples from both surveys had lead concentrations exceeding the European Union Maximum Level for meat from bovine animals, sheep, pigs and poultry (currently there is no level is set for game meat), some by several orders of magnitude. High, but feasible, levels of consumption of some species could result in the currently accepted limits of lead being exceeded. The potential health hazard from lead ingested in the meat of game animals may be larger than previous risk assessments indicated, especially for vulnerable groups, such as children, and those consuming large amounts of game.

(Full details in PLoS ONE; 2010, 5(4):e10315.doi:10.1371/journal.pone.0010315)

Pb Pellet Deposition and Availability

Abstract: Mourning dove hunting is becoming increasingly popular, especially hunting over managed shooting fields. Given the possible increase in lead (Pb) shot availability on these conservation areas, we estimated availability and ingestion of spent shot at the Eagle Bluffs Conservation Area (EBCA; hunted with nontoxic shot) and the James A. Reed Memorial Wildlife Area (JARWA; hunted with Pb shot) in Missouri. During 1998, we collected soil samples 1–2 weeks prior to the hunting season (pre-hunt) and after 4 days of dove hunting (post-hunt). We also collected information on number of doves harvested, number of shots fired, shotgun gauge, and shotshell size used. Dove carcasses were collected on both areas during 1998-99. At EBCA, 60 hunters deposited an estimated 64,775 pellets/ha of nontoxic shot on or around the managed field. At JARWA, approximately 1,086,275 pellets/ha of Pb shot were deposited by 728 hunters. Our post-hunt estimates of spent shot availability from soil sampling were 0 pellets/ha for EBCA and 6,342 pellets/ha for JARWA. Our findings suggest that existing soil sampling protocols may not provide accurate estimates of spent shot availability in managed dove shooting fields. During 1998-99, 15 of 310 (4.8%) mourning doves collected from EBCA had ingested nontoxic shot. For doves that ingested shot, 6 (40.0%) contained ≥7 shot pellets. In comparison, only 2 of 574 (0.3%) doves collected from JARWA had ingested Pb shot. Because a greater proportion of doves ingested multiple steel pellets compared to Pb pellets, we suggest that doves feeding in fields hunted with Pb shot may succumb to acute Pb toxicosis and thus become unavailable to harvest, resulting in an underestimate of ingestion rates. Although further research is needed to test this hypothesis, our findings may partially explain why previous studies have shown few doves with ingested Pb shot despite feeding on areas with high Pb shot availability. Funding and support for this study were provided by the Missouri Department of Conservation's Resource Science Center

(Federal Aid in Wildlife Restoration Project W-13-R), and the University of Missouri's Department of Fisheries and Wildlife Sciences. **(Full details available in Wildlife Society Bulletin; 2002, 30(1):112-120)**

Ingested Shot and Tissue Lead Concentrations in Mourning Doves

Abstract: A more complete understanding of non-hunting and harvest mortality for mourning doves (*Zenaida macroura*) will be critical to improving regional and national harvest management decisions. Poisoning from ingested lead shot is of particular concern in mourning doves, which are often hunted on managed shooting fields where lead shot densities can be high, potentially increasing the risk of lead exposure. Previous studies of lead exposure in mourning doves have been local in scope and sample sizes have varied widely among areas. We provide an evaluation of lead exposure in 4,884 hunter-harvested mourning doves from Arizona, Georgia, Missouri, Oklahoma, Pennsylvania, South Carolina, and Tennessee. Overall, the frequency of ingested lead pellets in gizzards of doves on hunting areas where the use of lead shot was permitted was 2.5%, although we found a high degree of variability among locations. On areas where nontoxic shot was required, 2.4% of mourning doves had ingested steel shot. Hatch year (HY) doves had a greater frequency of ingested lead and steel pellets than after hatch year (AHY) birds, suggesting that they either ingested pellets more frequently or that young birds with ingested shot were preferentially harvested over older birds with ingested pellets. In doves without ingested lead pellets, bone lead concentrations were lower on an area requiring the use of nontoxic shot than on areas allowing the use of lead shot. **(Full details available in FRANSON, J. C., S. P. HANSEN, AND J. H. SCHULZ. 2009. Ingested shot and tissue lead concentrations in Mourning Doves. *In* R. T. Watson, M. Fuller, M. Pokras, and W. G. Hunt (Eds.). Ingestion of Lead from Spent Ammunition: Implications for Wildlife and Humans. The Peregrine Fund, Boise, Idaho, USA)**

Acute Lead (Pb) Toxicosis

Abstract: Previous research has suggested that free-ranging mourning doves may ingest spent lead pellets, succumb to lead toxicosis, and die in a relatively short time period (i.e., an acute lead toxicosis hypothesis). We tested this hypothesis by administering 157 captive mourning doves 2–24 lead pellets, monitoring pellet retention and short-term survival, and measuring related physiological characteristics. During the 19–21-day post-treatment period, 104 doves that received lead pellets died (deceased doves) and 53 survived (survivors); all 22 birds in a control group survived. Within 24-hr of treatment, blood lead levels increased almost twice as fast for deceased doves compared to survivors ($P < 0.001$). During the first week, heterophil:lymphocyte (H:L) ratios increased twice as fast for deceased doves than with survivors ($P < 0.001$). Post-treatment survival differed ($P < 0.001$) among the five groups of doves that retained different numbers of pellets, and survival ranged from 0.57 (95% CI: 0.44–0.74) for doves that retained ≤2 lead pellets 2-days post-treatment compared to 0.08 (95% CI: 0.022–0.31) for those doves that retained 13–19 lead pellets on 2-days post-treatment; significant differences existed among the five groups. After controlling for dove pre-treatment body mass, each additional lead pellet increased the hazard of death by 18.0% (95% CI: 1.132–1.230, $P < 0.001$) and 25.7% (95% CI: 1.175–1.345, $P < 0.001$) for males and females, respectively. For each 1 g increase in pre-treatment body mass, the hazard of death decreased 2.5% ($P = 0.04$) for males and 3.8% ($P = 0.02$) for females. Deceased doves had the highest lead levels in liver (49.20 ± 3.23 ppm) and kidney (258.16 ± 21.85 ppm) tissues, whereas controls showed the lowest levels (liver, 0.08 ± 0.041 ppm; kidney, 0.17 ± 0.10 ppm). For doves dosed with pellets, we observed simultaneous increases in blood lead levels and H:L ratios, whereas packed-cell volume (PCV) values declined. Our results support an acute lead toxicosis hypothesis. Funding and support for this study were provided by the Missouri

Department of Conservation's Resource Science Center, and the University of Missouri's Department of Fisheries and Wildlife Sciences and Veterinary Medicine Diagnostic Laboratory. All animal care and use during these experiments were approved by the University of Missouri Animal Care and Use Committee **(Full details available in Journal of Wildlife Management; 2006, 70(2):413–421).**

Experimental Lead Pellet Ingestion In Mourning Doves

Abstract: Because the relationship between lead pellet availability and ingestion by mourning doves remains uncertain, we conducted an experiment to determine if doves held in captivity freely ingest lead shotgun pellets, investigate the relationship between pellet density and ingestion, and monitor physiological impacts of doves ingesting pellets. We conducted two trials of the experiment with <60 doves per trial. We randomly assigned 10 doves to one of six groups per trial; 10, 25, 50, 100, 200 pellets mixed with food and a control group with no pellets. We monitored ingestion by examining x-rays of doves 1-day post-treatment, and monitored the effects of lead ingestion by measuring heterophil:lymphocyte (H:L) ratios, packed-cell volume (PCV), blood lead, liver lead, and kidney lead. Pooled data from both trials showed 6 of 117 (5.1%) doves ingested lead pellets. Two mourning doves ingested multiple lead pellets in each of the treatments containing a mixture of 25, 100, and 200 lead pellets and food. Doves ingesting lead pellets had higher blood lead levels than before treatment ($P = 0.031$). Post-treatment H:L ratios, however, were not different compared to pre-treatment values ($P = 0.109$). Although post-treatment PCV decreased for 4 of 6 doves ingesting lead pellets, overall they were not lower than their pre-treatment values ($P = 0.344$). Liver ($P < 0.0001$) and kidney ($P = 0.0012$) lead levels for doves ingesting pellets were higher than doves without ingested pellets. Our lead pellet ingestion rates were similar to previously reported ingestion rates from hunter-killed doves, and our physiological measurements confirm earlier reports of a rapid and acute lead toxicosis. Similar to previous field research, we did not observe a relationship between pellet density in the food and *ad libitum* pellet ingestion. **(Full details available in American Midland Naturalist; 2007, 158(1):177–190)**

Small Game Hunter Attitudes Toward Nontoxic Shot

Abstract: Besides waterfowl, wildlife managers are becoming more concerned about the exposure of birds to spent lead shot. Knowledge of hunter attitudes and their acceptance of nontoxic shot regulations will be important in establishing new regulations. Our objective was to assess the attitudes of small game hunters in Missouri towards a nontoxic shot regulation for small game hunting in general, and specifically for mourning doves. Most hunters (71.7–84.8%) opposed additional nontoxic shot regulations. Hunters from rural areas, hunters with a rural background, hunters who hunt doves, hunters who currently hunt waterfowl, hunters who primarily used private lands, and current upland game hunters were more likely to oppose new regulations. For mourning dove hunting, most small game hunters (81.1%) opposed further restrictions; however, many non-dove hunters (57.1%) expressed "no opinion." Because our results demonstrate that most small game and dove hunters in Missouri are decidedly against further nontoxic shot regulations, any informational and educational programs developed to accompany future policy changes must address there concerns. Funding and support for this study were provided by the Missouri Department of Conservation's Resource Science Center, and the University of Missouri's Department of Fisheries and Wildlife Sciences. **(Full details available in Journal of Wildlife Management; 2007, 71(2):628–633)**

Nontoxic Shot and Crippling Rates

Abstract: Increasing concerns about the exposure of mourning doves to spent lead shot may lead to a review of lead shot restrictions. Policy reviews regarding current restrictions likely will

involve debates about whether nontoxic shot requirements will result in increased crippling loss of mourning doves. We evaluated waterfowl crippling rates in the United States prior to, during, and after implementation of nontoxic shot regulations for waterfowl hunting. We used this information to make inferences about mourning dove crippling rates if nontoxic shot regulations are enacted. We found differences in moving average crippling rates among the 3 treatment periods for ducks ($P < 0.001$, $n = 49$). Prenontoxic-shot-period crippling rates were lower than 5-year phase-in period crippling rates ($P = 0.043$) but higher ($P < 0.001$) than nontoxic-shot-period crippling rates. Similarly, we observed differences in moving average crippling rates among the 3 treatment periods for geese ($P < 0.001$, $n = 49$). Prenontoxic-shot- and 5-year-phase-in-period crippling rates were both greater than ($P < 0.001$) nontoxic-shot-period crippling rates but did not differ from one another ($P = 0.299$). Regardless of why the observed increases occurred in reported waterfowl crippling rates during the phase-in period, we believe the decline that followed full implementation of the nontoxic shot regulation is of ultimate importance when considering the impacts of lead shot restrictions for mourning doves. We argue that long-term mourning dove crippling rates might not increase as evidenced from historical waterfowl data. Funding and support for this investigation were provided by the Missouri Department of Conservation's Resource Science Center, and the University of Missouri's Department of Fisheries and Wildlife Sciences and Veterinary Medicine Diagnostic Laboratory. **(Full details available in Wildlife Society Bulletin; 2006, 34(3):861–865)**

The Question of Lead: considerations for a mourning dove nontoxic-shot regulation

Abstract: The use of lead (Pb) in sport hunting and angling is becoming a priority issue with wildlife professionals and policymakers. Lessons from implementation of nontoxic-shot regulations for waterfowl can provide helpful guidance. In addition to waterfowl, however, new information demonstrates the impacts of Pb-based sporting ammunition and fishing tackle on a wide variety of wildlife, and human impacts with Pb fragments in venison. Given these complexities, we suggest focusing on mourning doves as a starting point for a national nontoxic-shot regulation based upon the substantial amount of reliable information and the possibility of having the greatest immediate environmental impact. A critical first step in the policy process is an explicit recognition of all affected stakeholders to ensure broad input and support. The success of any policy implementation will ultimately be facilitated with leadership from professional organizations and natural resource management agencies. **(Full details available in The Wildlife Professional; 2009, 3(2):46–49)**

Table 1. Estimates of the number of doves harvested, number of hunters, and days afield by state in the Central Management Unit (CMU; Figure 2) from the Migratory Game Bird Harvest Information Program (HIP) survey for the 2010–11 hunting season.

	HARVEST		HUNTERS		DAYS		SEASONAL HARVEST	
Arkansas	446,400	(±28)[1]	23,900	(±20)	63,300	(±28)	18.7	(±34)
Colorado	172,000	(±18)	15,900	(±14)	38,400	(±19)	10.8	(±22)
Kansas	511,200	(±15)	28,200	(±10)	93,900	(±13)	18.1	(±18)
Minnesota	98,900	(±58)	10,000	(±36)	55,300	(±115)	9.9	(±72)
Missouri	426,000	(±20)	29,300	(±10)	75,200	(±14)	14.5	(±23)
Montana	17,400	(±36)	1,600	(±35)	4,700	(±44)	10.7	(±50)
Nebraska	276,400	(±19)	15,800	(±14)	49,700	(±21)	17.5	(±24)
New Mexico	128,000	(±29)	5,900	(±20)	21,000	(±20)	21.9	(±35)
North Dakota	54,200	(±38)	3,800	(±28)	11,800	(±37)	14.1	(±48)
Oklahoma	268,700	(±28)	19,500	(±14)	51,300	(±22)	13.8	(±31)
South Dakota	64,300	(±23)	5,000	(±21)	14,200	(±26)	12.9	(±31)
Texas	4,699,300	(±14)	244,600	(±10)	876,500	(±10)	19.2	(±17)
Wyoming	32,100	(±36)	2,700	(±26)	7,100	(±32)	12.0	(±45)
CMU Total	7,194,900	(±10)	406,100[2]		1,362,300	(±8)		

[1]This represents the 95% confidence interval expressed as percent of the point estimate.

[2]This total may be slightly exaggerated because some people may be counted more than once if they hunted in more than one state, and explains why there is no estimated confidence interval.

Table 2. Percent change of the 2011 Roadside Mourning Dove Survey relative to 2010, 5-year (2006–10), and 10-year (2001–10) averages by Zoogeographic regions (Figure 2a) and MDC management regions (Figure 2b).

Zoogeographic regions	**2011 Index[a]**	**2-year (2010-2011) % change**	**5-year (2006-2010) % change**	**10-year (2001-2010) % change**
Northwest Prairie (11) [b]	1.27	0.56	-20.53	-23.35
Northern Riverbreaks (11)	1.60	35.59	28.66	20.41
Northeast Riverbreaks (20)	1.20	13.05	-16.92	-13.43
Western Prairie (12)	1.49	-12.29	-15.28	-10.46
Western Ozark Border (13)	1.42	21.69	-9.17	-6.48
Ozark Plateau (24)	0.59	2.62	-20.14	-9.30
Northern and Eastern Ozark Border (12)	1.06	-5.91	5.16	6.76
Mississippi Lowlands (7)	2.59	-8.90	-9.07	-6.34
STATEWIDE (110)	1.24	4.75	-9.43	-7.16

MDC management regions	**2011 Index[a]**	**2-year (2010-2011) % change**	**5-year (2006-2010) % change**	**10-year (2001-2010) % change**
Northwest (19) [b]	1.49	22.27	3.06	-3.60
Northeast (15)	1.06	-0.89	-19.75	-16.89
Kansas City (10)	1.37	-5.74	-21.39	-21.83
Central (15)	1.14	-3.92	-27.60	-19.79
St. Louis (6)	0.99	43.29	29.72	32.06
Southwest (17)	1.30	2.49	-5.18	1.57
Ozark (12)	0.61	21.70	-8.25	0.88
Southeast (16)	1.64	-4.25	-2.59	-0.68
Statewide (110)	1.24	4.75	-9.43	-7.16

[a]Survey index is equal to the number of mourning doves observed per mile.
[b]Number of counties within zoogeographic region with a completed and returned survey route.

Table 3. Dove harvest characteristics during September 2010 from conservation areas cooperating with an Adaptive Resource Management (ARM) program to evaluate the effects of different hunter and harvest management strategies on the goal of maximizing hunting opportunities[1].

Area	Number of Hunters	Doves Killed	Shots Fired	Hours Hunted	Doves Shot and Not Retrieved
A. A. Busch CA	448	280	1,970	1,197	64
Bois D'Arc CA	796	872	5,337	2,077	190
Columbia Bottom CA	956	2,550	13,859	3,671	495
Eagle Bluffs CA	121	239	973	392	31
Franklin Island CA	18	5	16	31	0
Otter Slough CA	145	818	3,218	383	67
Pony Express CA	418	358	2,164	1,396	40
J. A. Reed Mem. WA	1,090	2,121	12,695	2,982	428
R. E. Talbot CA	503	1,312	5,600	1,197	203
Ten Mile Pond CA	519	4,462	15,933	1,350	383
Total for Participating Conservation Areas[1]	5,450	13,395	64,000	16,103	1,941

[1]It is important to note that these areas represent just a few dove hunting opportunities on public areas, and are part of a long-term management experiment. The Department provides managed mourning dove hunting opportunities on approximately 5,000 acres located on 150 fields located on >90 public conservation areas.

Table 4. Managed shooting field characteristics and relative distribution of the harvest characteristics by relative field size, during 2010.

Area Code	Area Name	2010 # Acres	2010 # Fields	Ave. Field Size	Doves Killed per Acre[1]	Hunters per Acre[2]	Shots per Acre[4]	Hours per Acre[3]
ABCA	August A Busch CA	117.2	10	11.7	2.4	3.8	16.8	10.2
BDCA	Bois D'Arc CA	471.5	131	3.6	1.8	1.7	11.3	4.4
CBCA	Columbia Bottoms CA	174	21	8.3	14.7	5.5	79.6	21.1
EBCA	Eagle Bluffs CA	8	1	8	29.9	15.1	121.6	49.0
FICA	Franklin Island CA	32.2	2	16.1	0.2	0.6	0.5	1.0
OSCA	Otter Slough CA	818	15	54.3	1.0	0.2	4.0	0.5
PECA	Pony Express CA	131.6	30	4.4	2.7	3.2	16.4	10.6
RMWA	James A Reed Mem. WA	177.3	17	10.5	12.0	6.1	71.6	16.8
TACA	Talbot CA	97	25	3.9	13.5	5.2	57.7	12.3
TMCA	Ten Mile Pond CA	145	8	18.1	30.8	3.6	109.9	9.3
All Areas		2171.8	260	8.3	6.0	2.3	28.5	6.8

[1]Represents doves killed per managed acre during the entire month of September.
[2]Represents the number of hunters per managed acre during the entire month of September.
[3]Represents shots per managed acre during the entire month of September.
[4]Represents the number of hours spent by hunters per managed acre during the entire month of September; all hours were rounded up the next whole number.

Table 5. Number of hunting trips made by hunters estimated by matching conservation numbers throughout the month of September, 2010; e.g., we assume 215 hunters made one dove hunting trip on ABCA and 37 hunters made two trips, etc. Multiple trips may be over-estimated because some areas have hunters fill out another card when hunting different fields. Not all hunters provided a usable conservation number (see Table 1 for abbreviations of area names), therefore these are conservative estimates of the number of dove hunting trips during the month of September.

# Days Hunted	ABCA	BDCA	CBCA	EBCA	FICA	OSCA	PECA	RMWA	TACA	TMCA	Total Hunting Trips	% Hunting Trips
1	215	320	674	65	11	77	288	492	262	234	2638	77.34
2	37	86	82	18	1	17	34	126	56	50	507	14.86
3	13	35	12	3		6	9	53	16	17	164	4.81
4	4	16	5		1	1	1	14	8	10	60	1.76
5	3	3						5	1	7	19	0.56
6	1	5					1	3	1	2	13	0.38
7	1			1				1		2	5	0.15
8			1				1			1	3	0.09
9											0	0.00
10											0	0.00
11	1		1								2	0.06
12											0	0.00
13											0	0.00
14	1										1	0.03
Total	275	465	775	87	13	101	334	694	344	323	3411	100

Table 6. Estimated distance traveled in miles to hunt doves calculated from zip codes provided by hunters and zip code for conservation area, during September 2010.

Area Code	Area Name	N[1]	Mean	Min	Max	Q25	Median (Q50)	Q75
ABCA	August A Busch CA	439	23.8	0.0	560.9	11.9	16.3	29.7
BDCA	Bois D'Arc CA	774	44.9	0.0	1856.0	23.9	29.8	40.5
CBCA	Columbia Bottoms CA	936	31.9	0.0	735.2	17.1	30.9	41.8
EBCA	Eagle Bluffs CA	119	34.5	0.0	401.5	0.0	6.0	30.1
FICA	Franklin Island CA	16	37.3	0.0	151.0	0.0	27.8	54.5
OSCA	Otter Slough CA	137	55.6	0.0	1021.1	25.1	28.1	59.1
PECA	Pony Express CA	408	53.2	0.0	871.1	29.6	37.5	61.3
RMWA	James A Reed Mem. WA	1070	22.9	0.0	582.3	10.1	15.8	24.0
TACA	Talbot CA	484	49.7	0.0	537.8	31.0	41.9	52.8
TMCA	Ten Mile Pond CA	516	63.9	0.0	571.4	36.8	48.9	62.8

[1]Number of hunters providing a usable zip code.

[2]Q25, Q50, and Q75 represent the 1st, 2nd, and 3rd quartiles or percentiles of the data. For example, Q50 represents the middle value of distances traveled compared to the arithmetic mean that takes into account the far outside values.

Table 7. Recoveries of all mourning doves banded in Missouri and recovered in Missouri and elsewhere. For example, there was one dove banded in Missouri in 2010 that was recovered in Florida, and 187 doves banded in Missouri that were recovered in Missouri. Note these data were last updated January 2011; data are continually added and revised by the USGS Bird Banding Lab.

State Recovered	2003	2004	2005	2006	2007	2008	2009	2010	Grand Total
Alabama			1	1			1		3
Arkansas	2	3	1	1	1		3	7	18
Florida	1		1			2		1	5
Idaho			1						1
Illinois	2	2	2	7	11	5	8	2	39
Kansas	5	3	3	1	3	2	4		21
Kentucky		2	1		2	1	1	1	8
Louisiana	1		2			2	4	2	11
Mexico	1	1			1	1	1		5
Mississippi		2		4	1	2			9
Missouri	261	236	261	329	261	335	272	187	2142
Oklahoma				1	1		1		3
South Carolina		1		1		1			3
South Dakota				1					1
Tennessee			2	2	2	1	1	1	9
Texas	5	4	9	3	3	3	3	2	32
Utah				1					1
Grand Total	**278**	**254**	**284**	**352**	**286**	**355**	**299**	**203**	**2,311**
Total Doves Banded in Missouri	**2,397**	**2,358**	**1,899**	**2,723**	**2,140**	**2,764**	**2,950**	**3,170**	**20,401**

Table 8. Recoveries of mourning doves from only Missouri, and banded in Missouri and elsewhere; e.g., one dove banded in Kansas in 2010 was recovered in Missouri, and 187 doves banded in Missouri were recovered in Missouri. Most recoveries in Missouri are birds banded in Missouri.

Banding State	2003	2004	2005	2006	2007	2008	2009	2010	Grand Total
Alabama					1				1
Arkansas	1								1
Florida	1								1
Georgia				1					1
Illinois				4	1	1	3	2	11
Iowa		4	3	2	2	2			13
Kansas	8	2	2	3			2	1	18
Kentucky						1			1
Louisiana	1			1					2
Mississippi	1								1
Missouri	261	236	261	329	261	335	272	187	2142
New York					1				1
Ohio						1			1
Oklahoma						1	2		3
South Dakota				1	1				2
Tennessee	1								1
Grand Total	**274**	**242**	**266**	**341**	**267**	**341**	**279**	**190**	**2200**

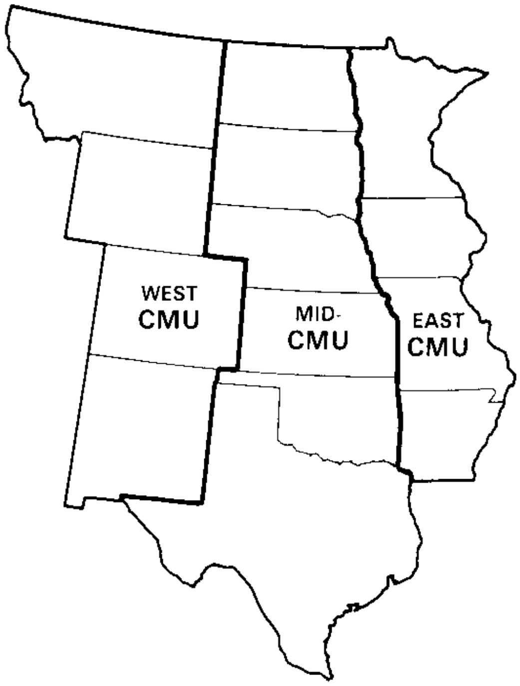

Figure 1a. The Central Management Unit (CMU) consists of 14 states containing roughly 46% of the U.S. land area, and routinely has the highest Call-Count Survey (CCS) indices in the country.

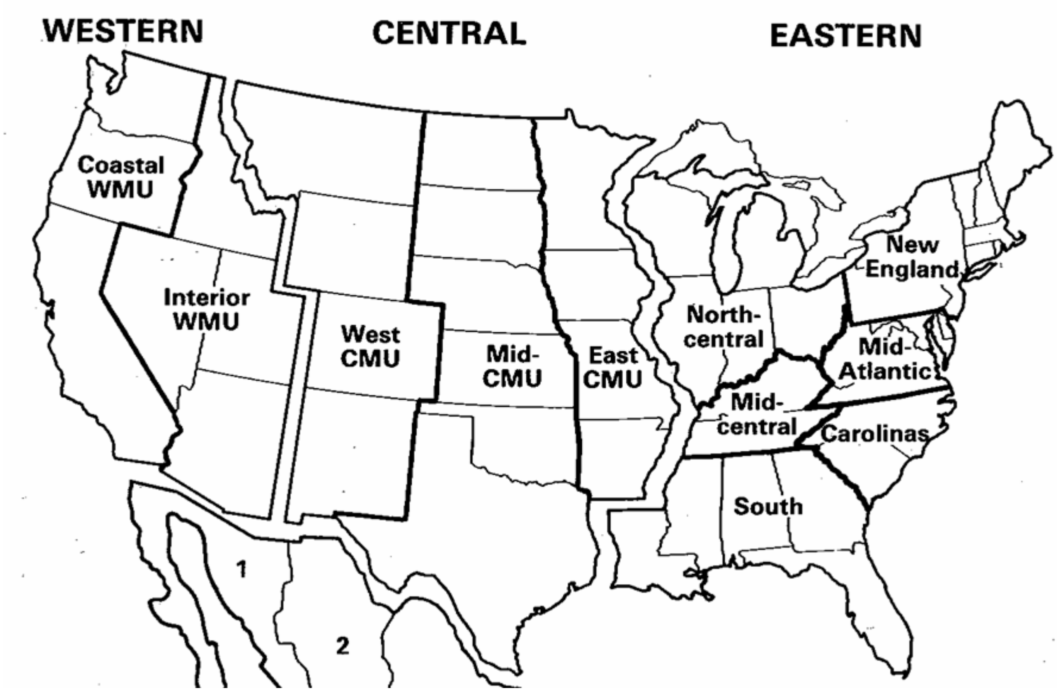

Figure 1b. Within the United States, there are 3 zones, or management units, that contain mourning dove populations that are roughly independent of each other. These zones encompass the principle breeding, migration, and U.S. wintering areas for each population. Harvest management decisions are annually established by management unit.

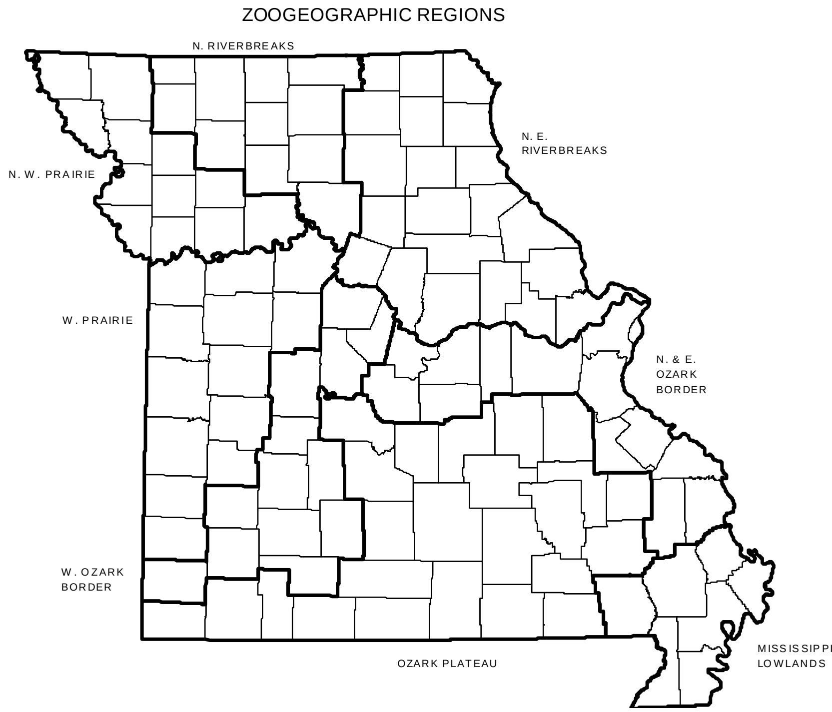

Figure 2a. Zoogeographic regions of Missouri.

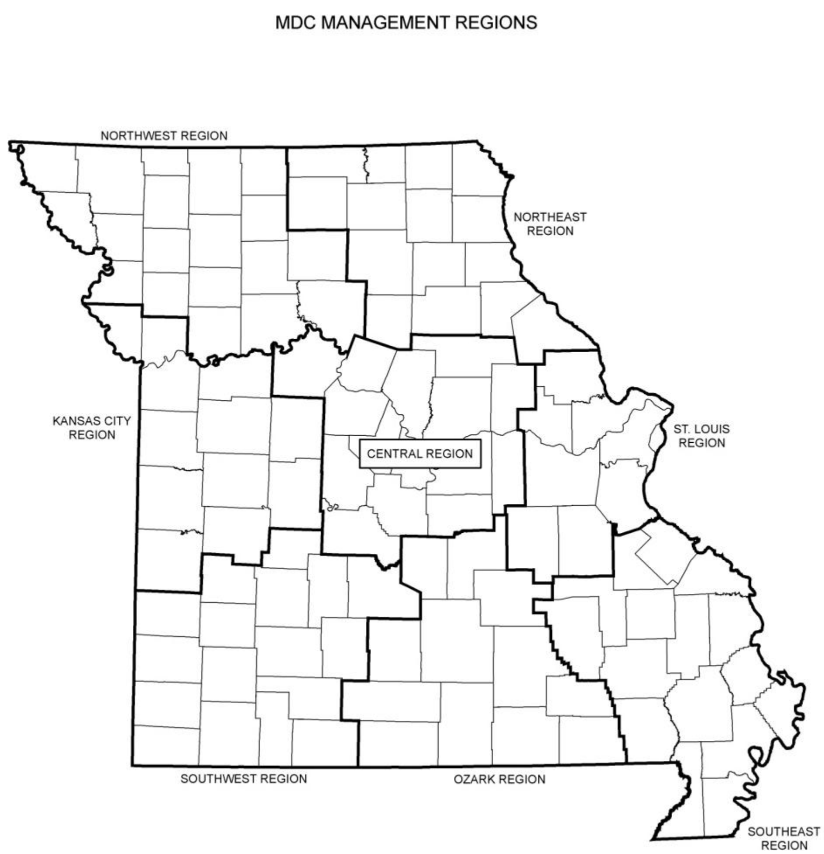

Figure 2b. MDC management regions.

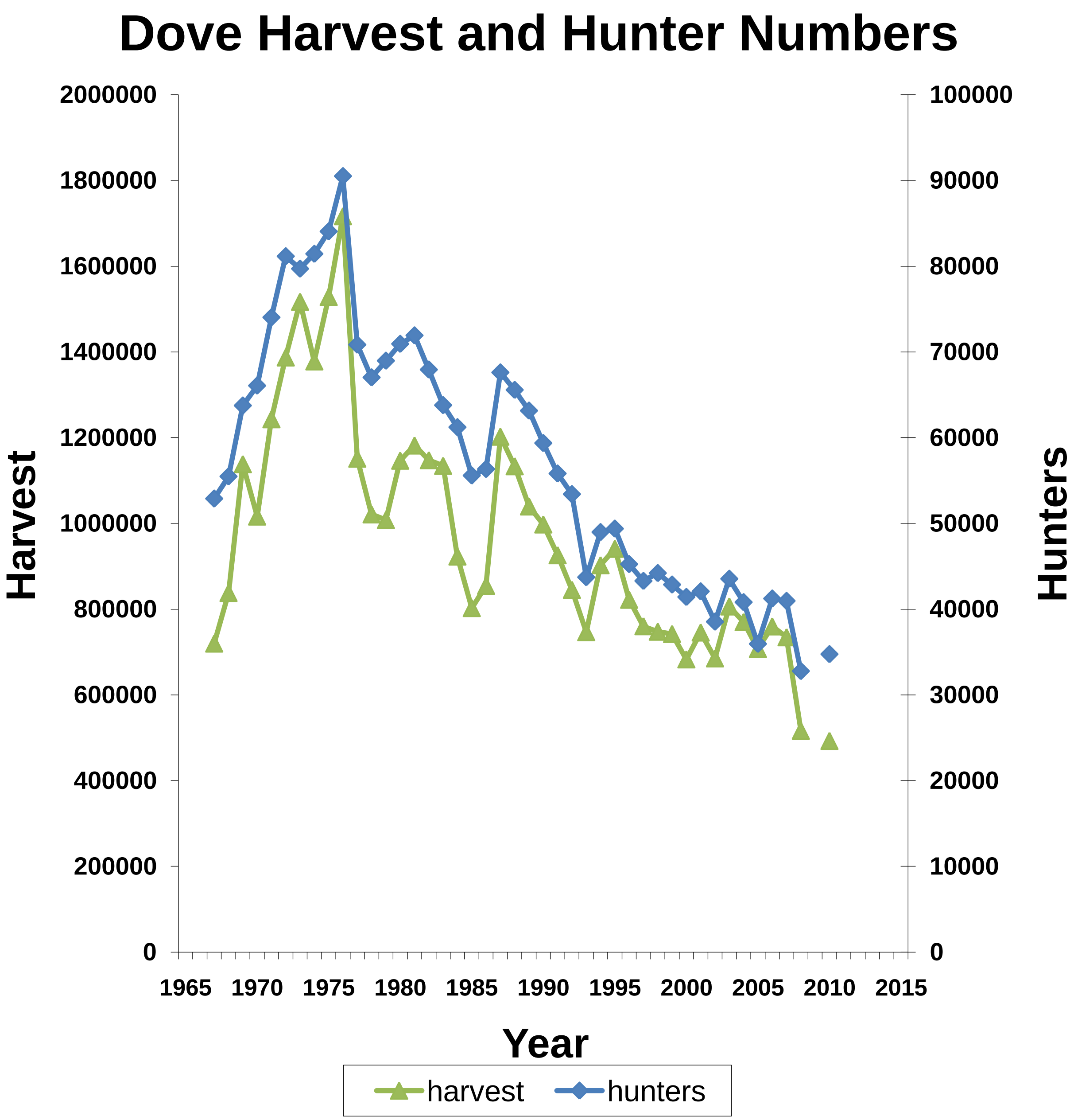

Figure 3. Long-term trends (1967– 2010) of mourning dove harvest and number of dove hunters in Missouri estimated annually by the small-game post-season harvest mail survey; note, starting in 2008 the small game hunter post-season harvest survey was conducted every-other year.

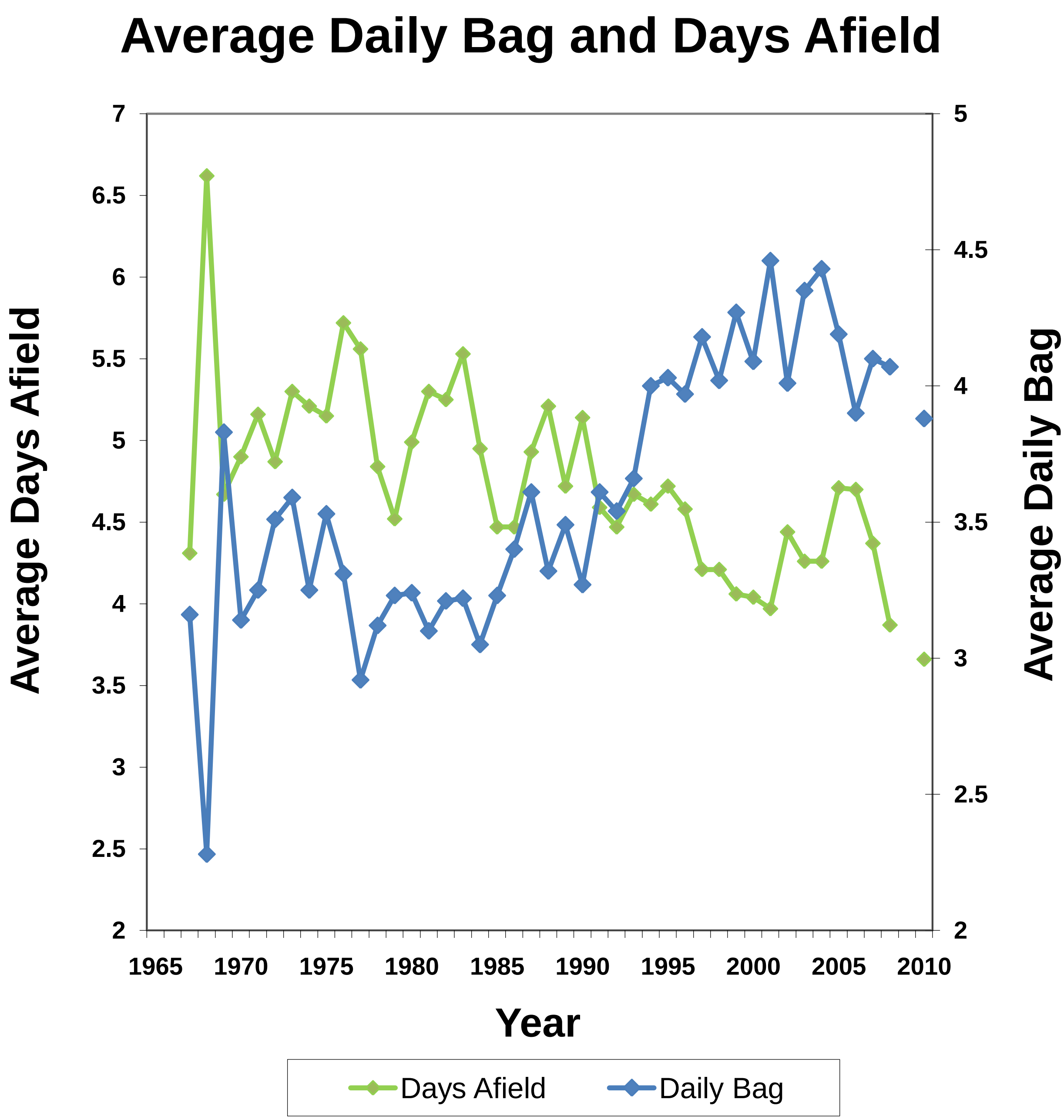

Figure 4. Long-term trends (1967–2010) of mourning dove average daily bag limit and average number of days afield for Missouri dove hunters estimated annually by the small-game post-season harvest mail survey; note, starting in 2008 the small game hunter post-season harvest survey was conducted every-other year.

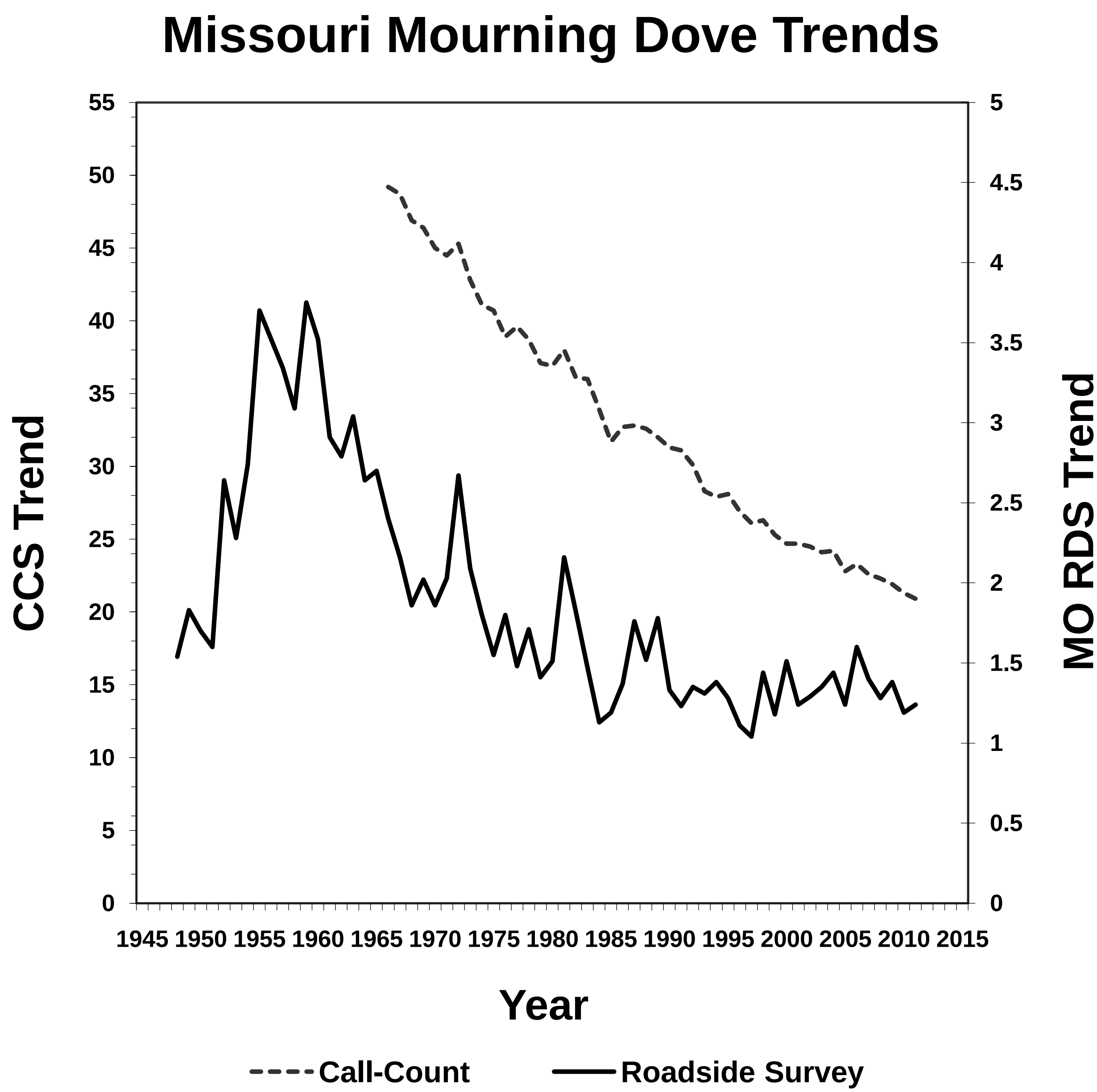

Figure 5. Missouri roadside mourning dove survey (RDS; doves observed along survey route) expressed as doves/mile (1947–2011) and U.S. Fish and Wildlife Service mourning dove call-count survey (CCS; doves heard calling) route regression trend analysis (1966–2011).

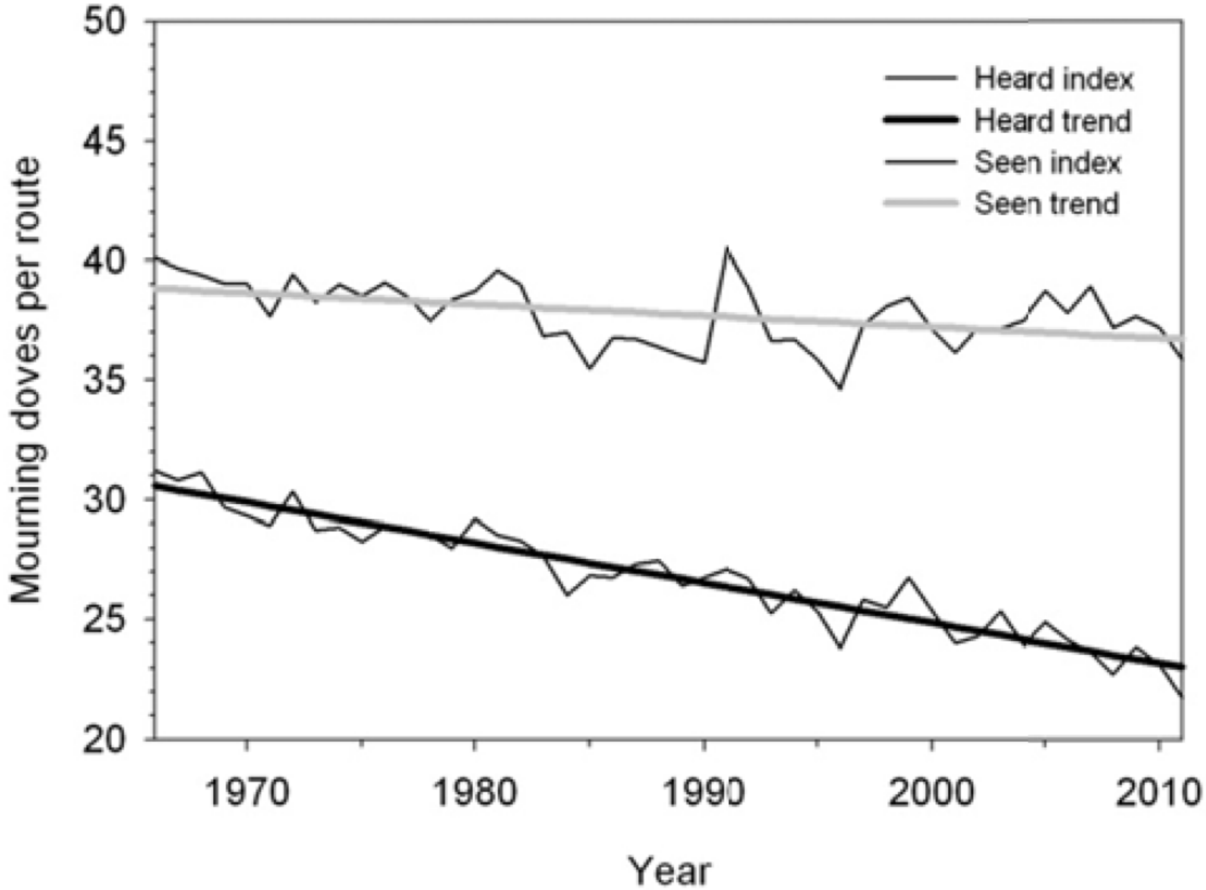

Figure 6. Call-Count Survey (CCS) trends in the Central Management Unit (CMU) of doves heard calling (heavy solid line) and doves observed (light solid line) for the Central Management Unit (CMU); from the USFWS 2011 Mourning Dove Status Report).

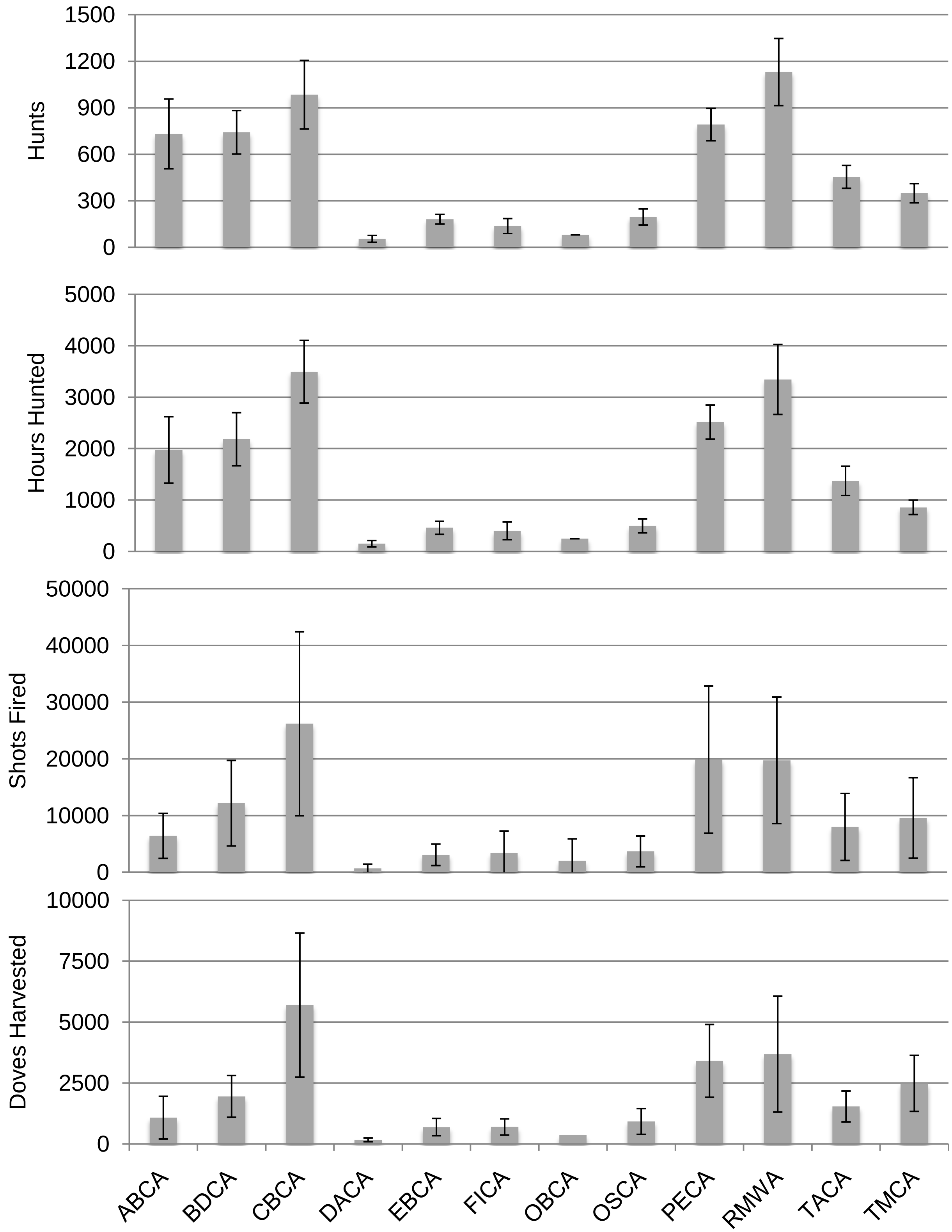

Figure 7. Average yearly total of hunts (or hunters), hours hunted, shots fired, and doves harvested (with 95% CIs shown with black lines) during September on MDC areas, 1998–2009 (see Tables 3 and 4 for acronym details).

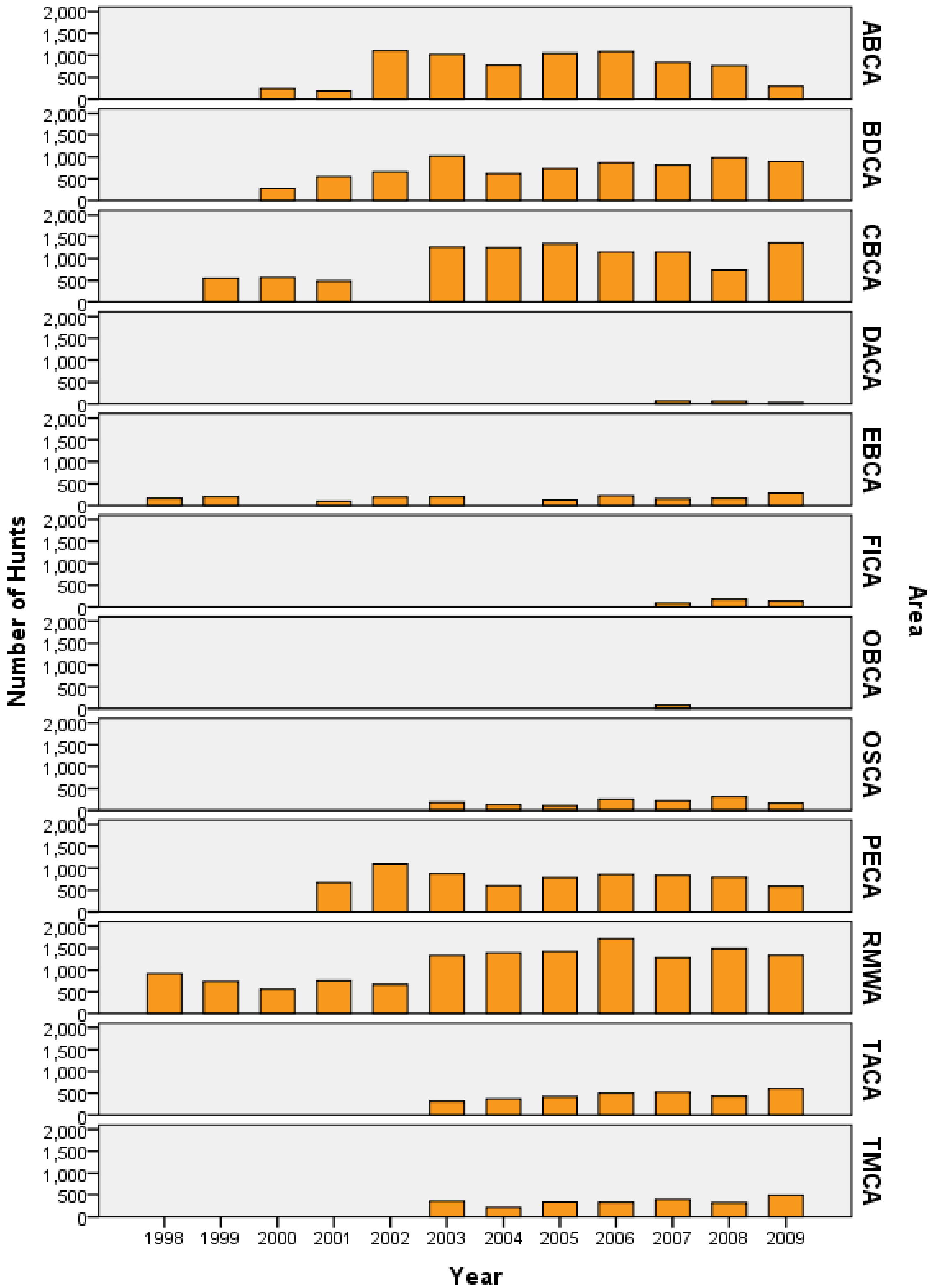

Figure 8. Yearly totals (through September) of the number of hunts (or hunters) on MDC areas from 1998–2009 (see Tables 3 and 4 for acronym details); we assumed that each card was a different hunter although some areas require a new card each time a hunter changes fields.

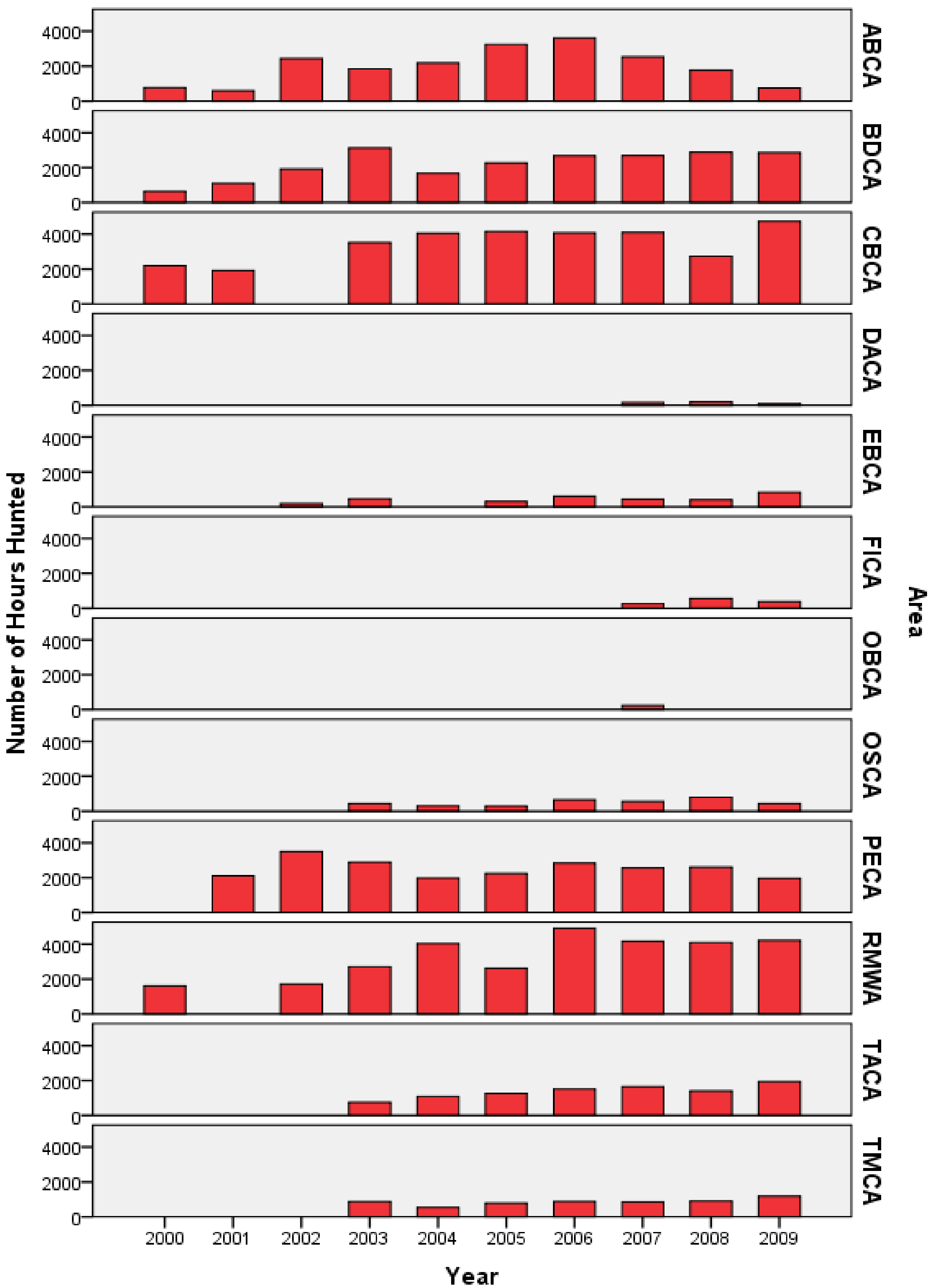

Figure 9. Yearly totals (through September) of the number of hours hunted on MDC areas from 1998–2009 (see Tables 3 and 4 for acronym details).

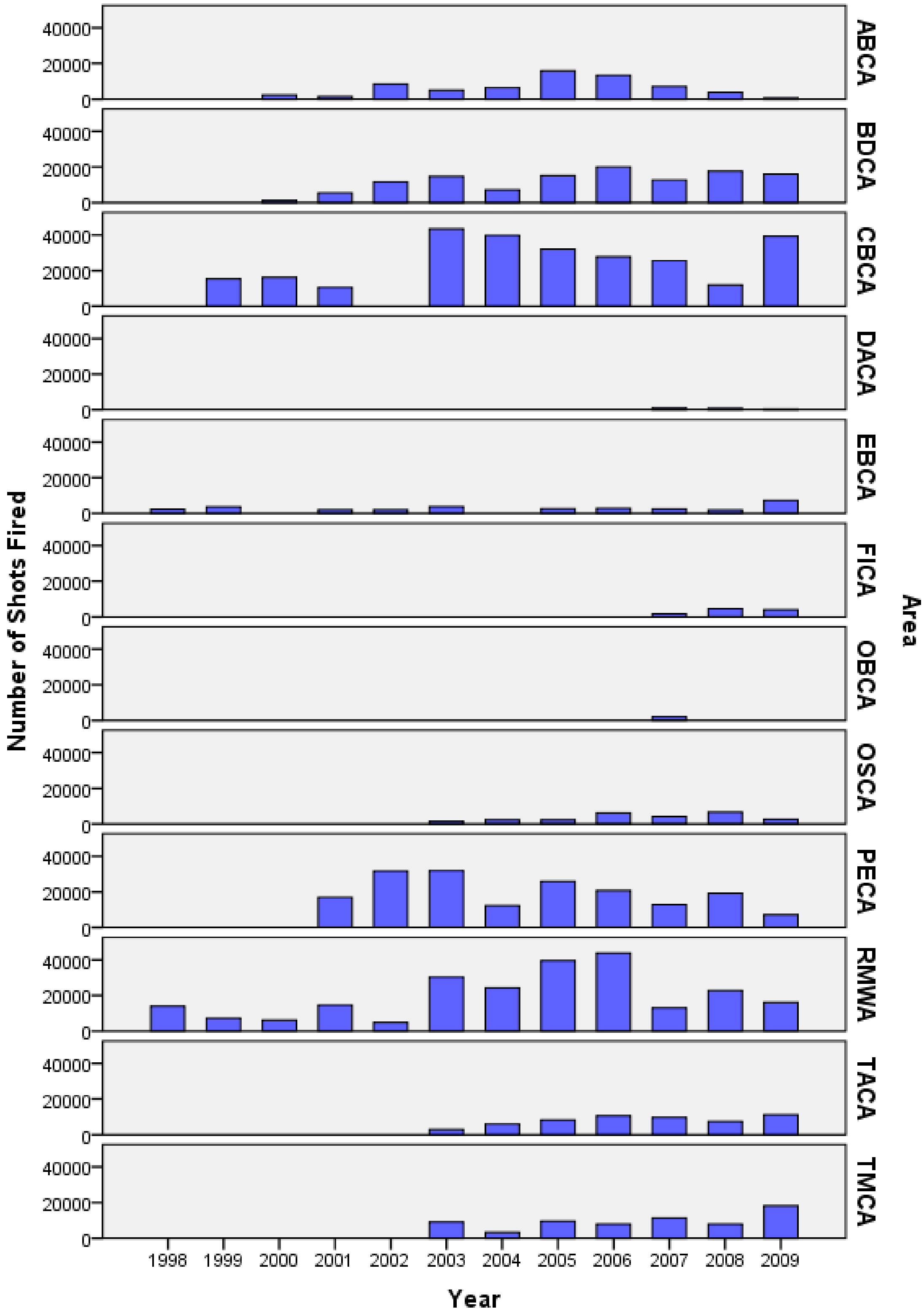

Figure 10. Yearly totals (through September) of the number of shots fired on MDC areas from 1998–2009 (see Tables 3 and 4 for acronym details).

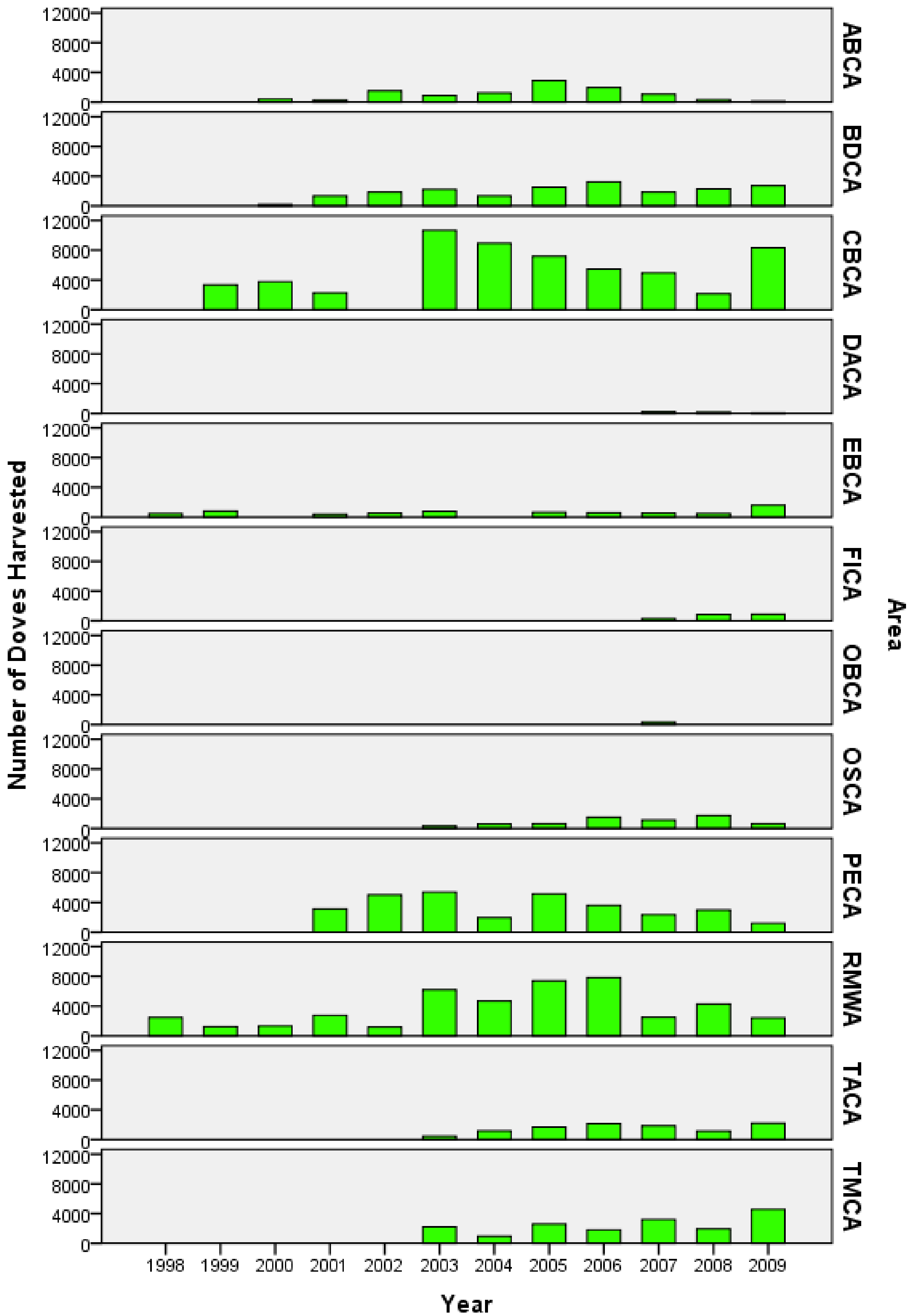

Figure 11. Yearly totals (through September) of the number of doves harvested on MDC areas from 1998–2009 (see Tables 3 and 4 for acronym details).

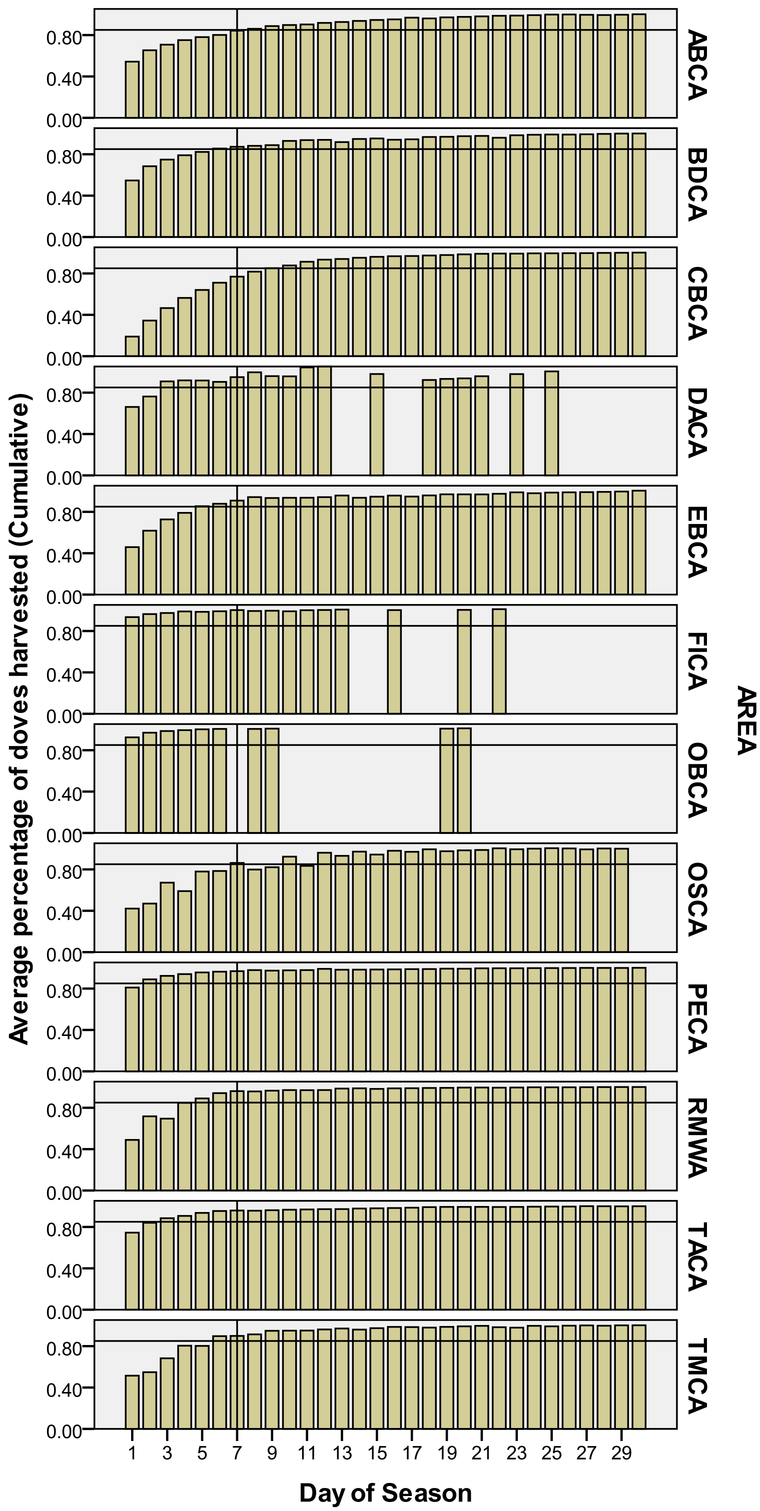

Figure 12. Cumulative dove harvest throughout the first 30 days of the season for MDC areas. Values are averaged across year (1998–2009). The horizontal reference lines correspond to the seventh day of hunting (or first week) and 85% of doves harvested (or cumulative harvest).

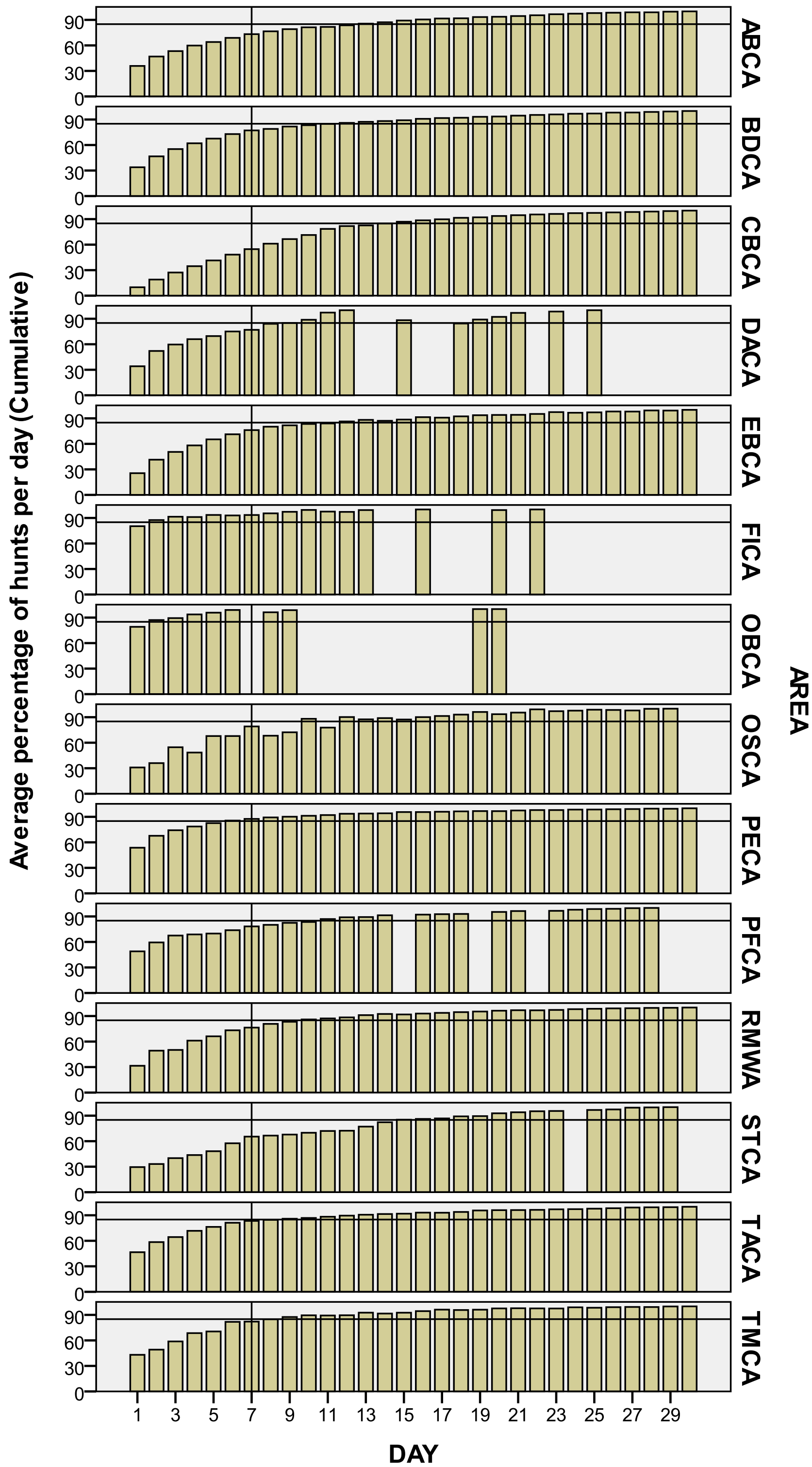

Figure 13. Cumulative number of dove hunters (or hunts) throughout the first 30 days of the season for MDC areas. Values are averaged across year (1998–2009). The reference lines correspond to the seventh day of hunting (first week) and 85% of hunts/hunters (or cumulative number of hunters).

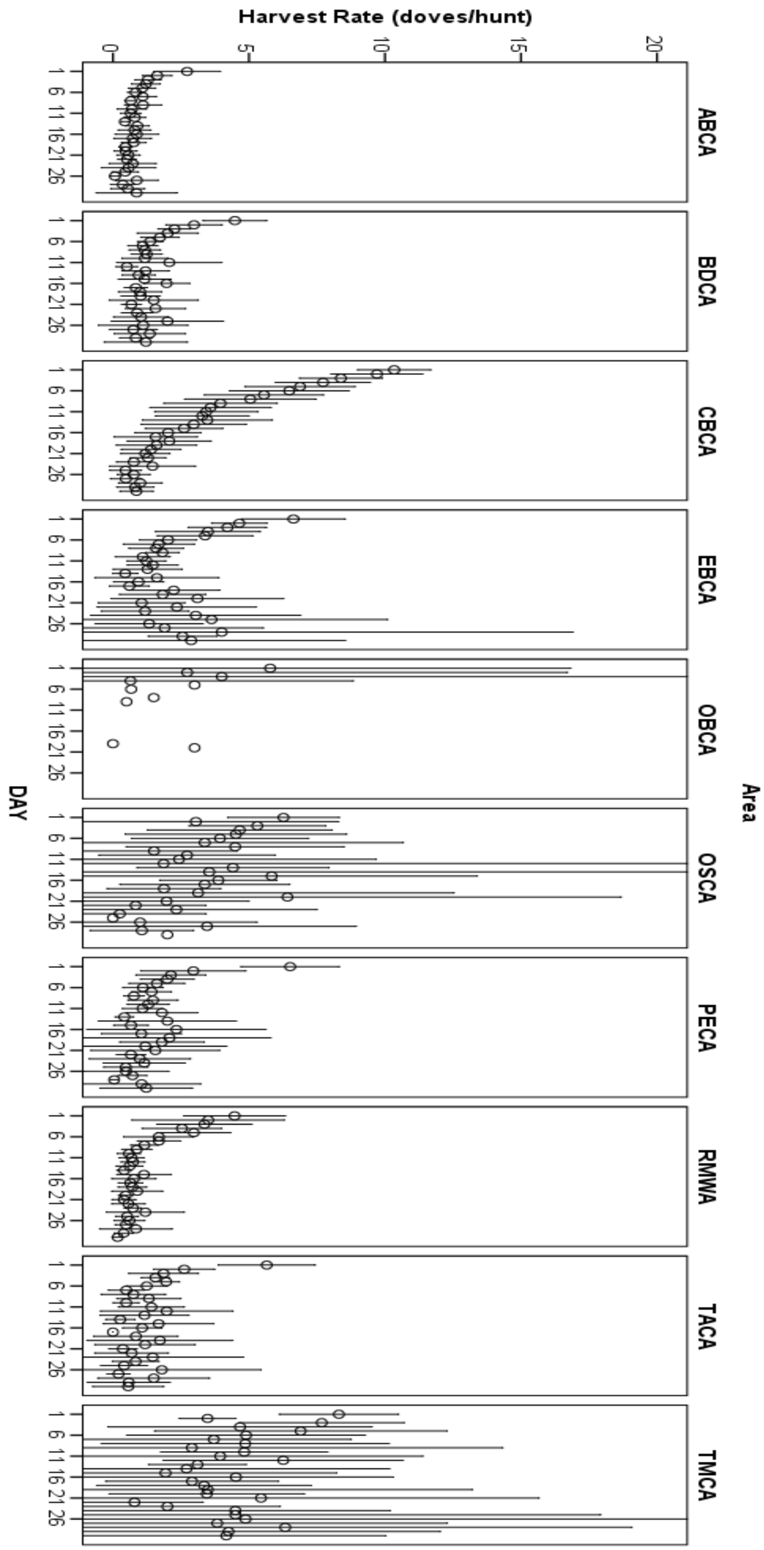

Figure 14. Multi-year averages and 95% CIs of daily harvest rates (doves per hunt) throughout September for a select set of MDC areas from 1998 – 2009. With the exception of Otter Slough (OSCA) and Ten Mile Pond (TMCA), most areas show a general pattern of relatively "high" harvest rate (doves/hunts) early in the season with rates declining throughout the season. OSCA and TMCA patterns may reflect "as posted" regulations.

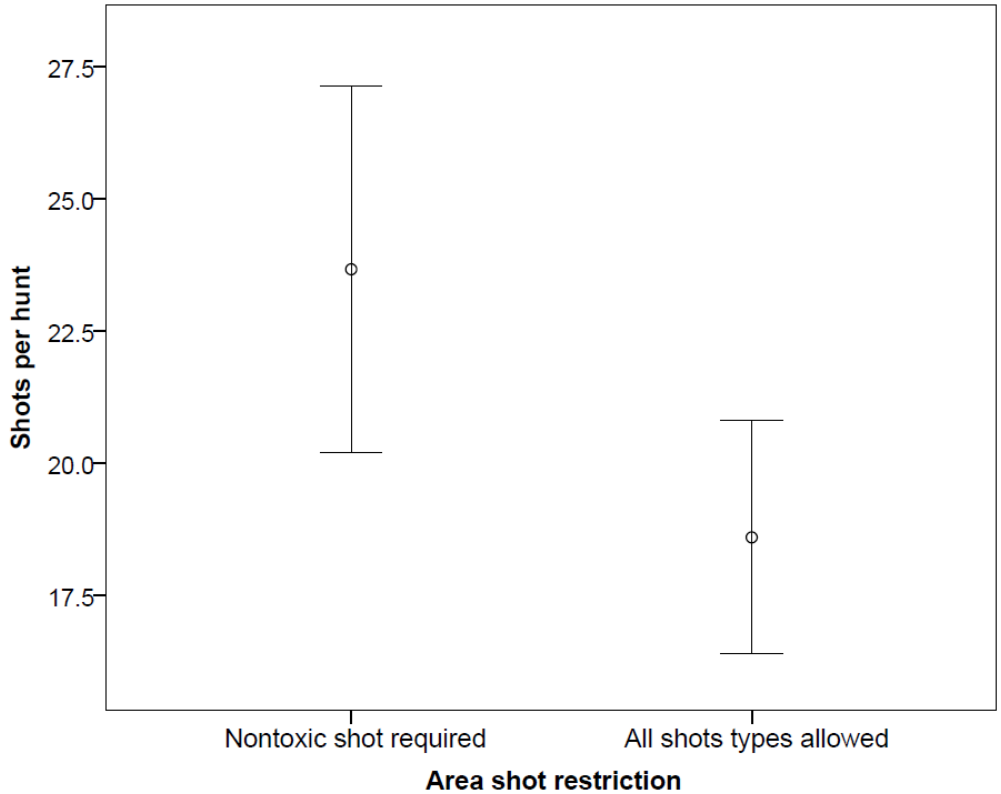

Figure 15a. Average number of shots per hunt (95% CI) during 2005–2009 on 4 areas requiring nontoxic shot (CBAC, EBCA, OSCA, and TMCA) and areas without a shot-type regulation (ABCA, BDCA, PECA, RMWA, and TACA)

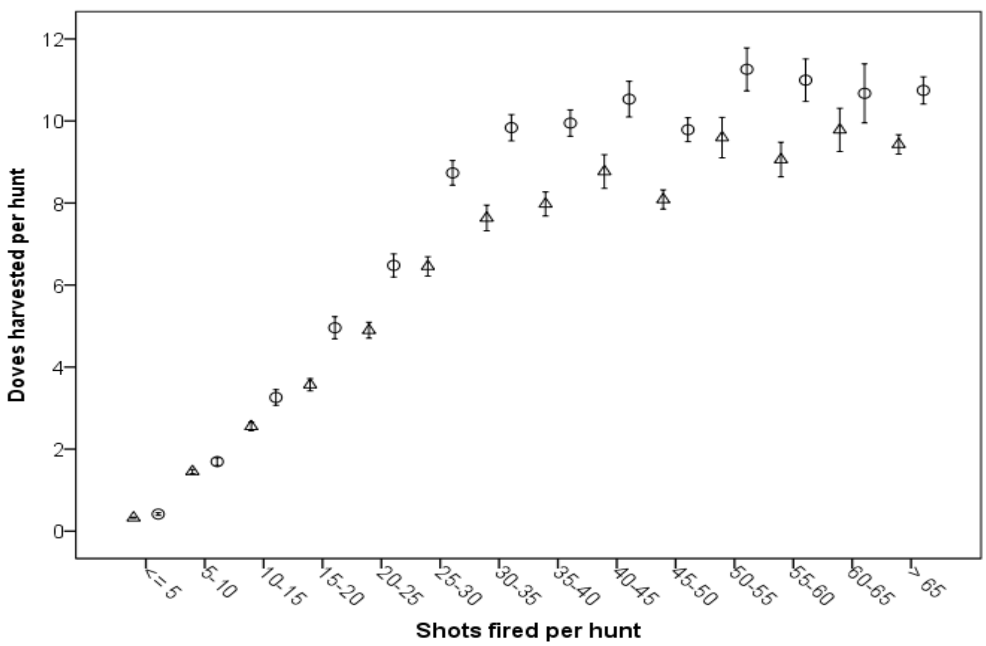

Figure 15b. Mean (95% CI) doves harvested on hunts by the number of shots fired on Conservation Areas during 2005–2009; circles=nontoxic-shot areas, triangles=all shot types allowed; Spearman's Correlation=0.82 (*n* = 51,718).

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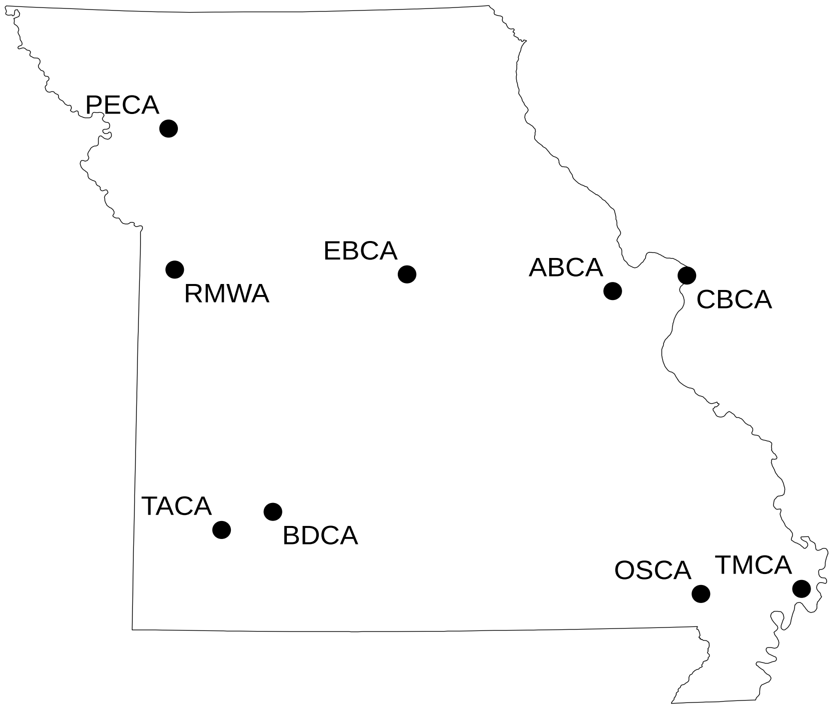

Figure 16. Locations of 9 public areas participating in mourning dove harvest management, 2005–2009; August A. Busch Conservation Area (ABCA), Bois D'Arc Conservation Area (BDCA), Columbia Bottom Conservation Area (CBCA), Eagle Bluffs Conservation Area (EBCA), Otter Slough Conservation Area (OSCA), Pony Express Conservation Area (PECA), James A. Reed Memorial Wildlife Area (RMWA), Robert E. Talbot Conservation Area (TACA), and Ten Mile Pond Conservation Area (TMCA).

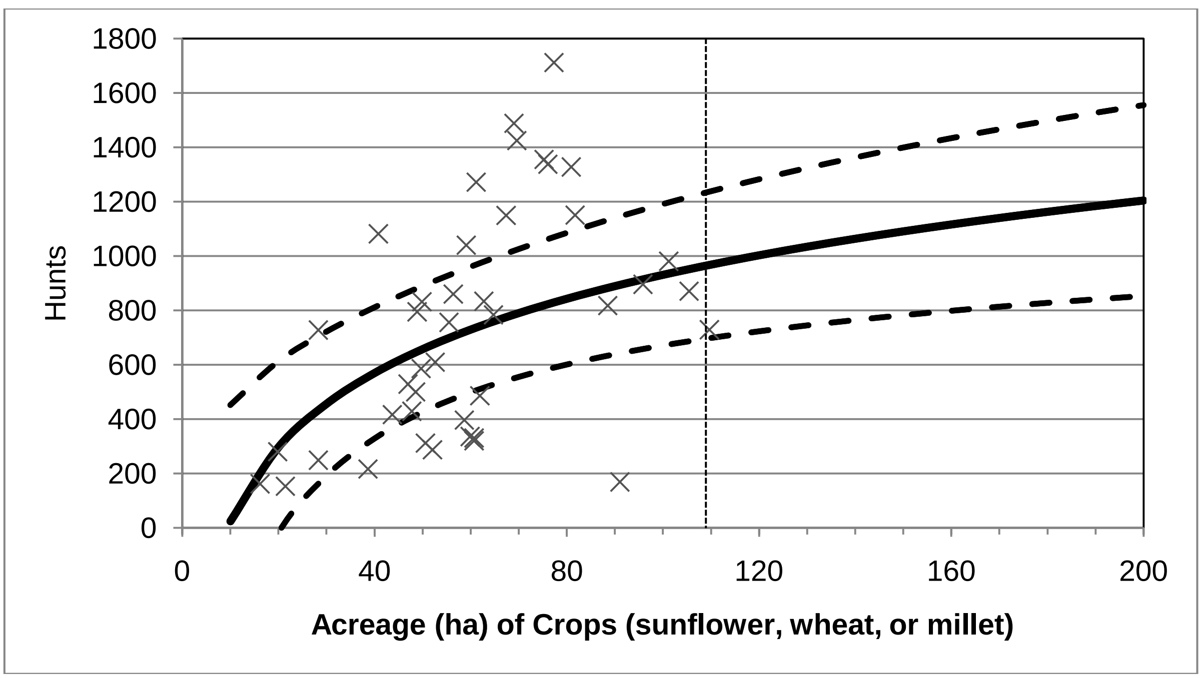

Figure 17. Raw values and graphical interpretation of the effect of crop acreage on the number of dove hunts (or hunters) occurring in September 2005–2009. Estimates to the left of the vertical reference line are within the range of acreages observed across areas, while predictions to the right of the line are beyond the range of current data. Dashed lines represent bootstrapped 95% confidence intervals.

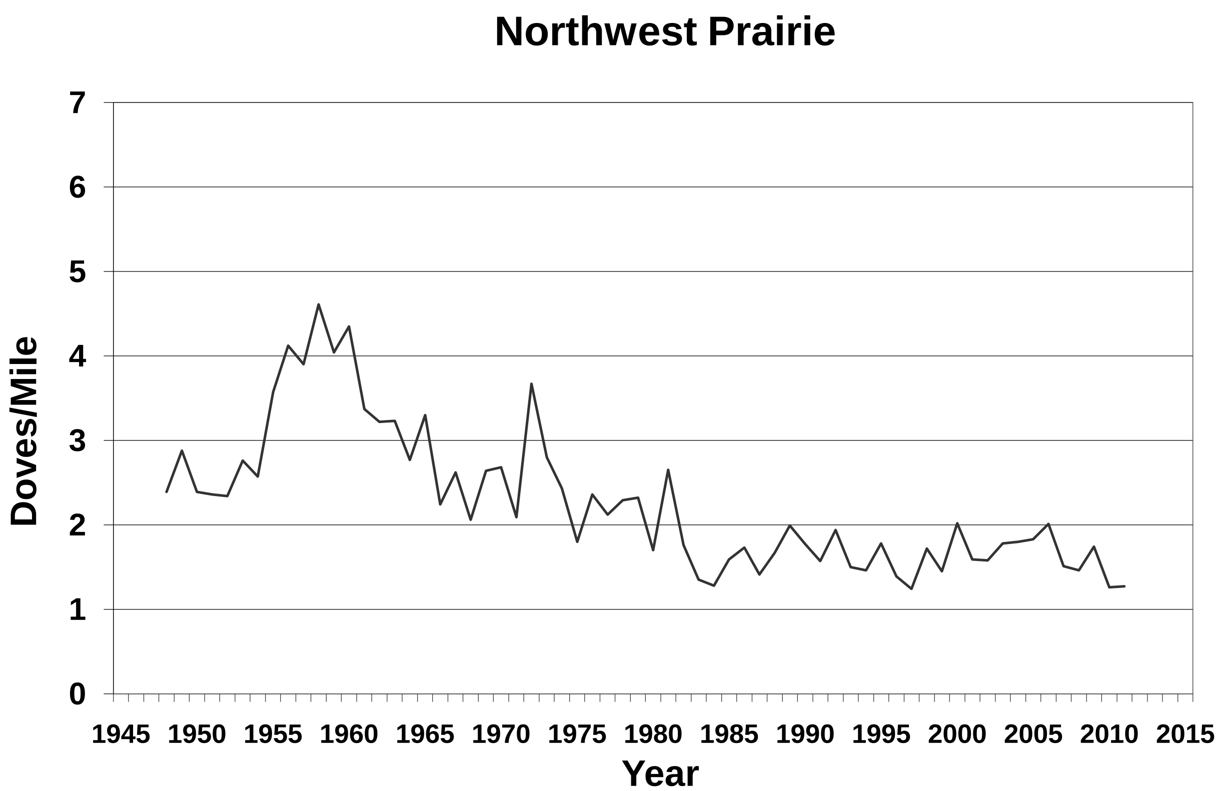

Figure 18. Northwest Prairie Zoogeographic Region.

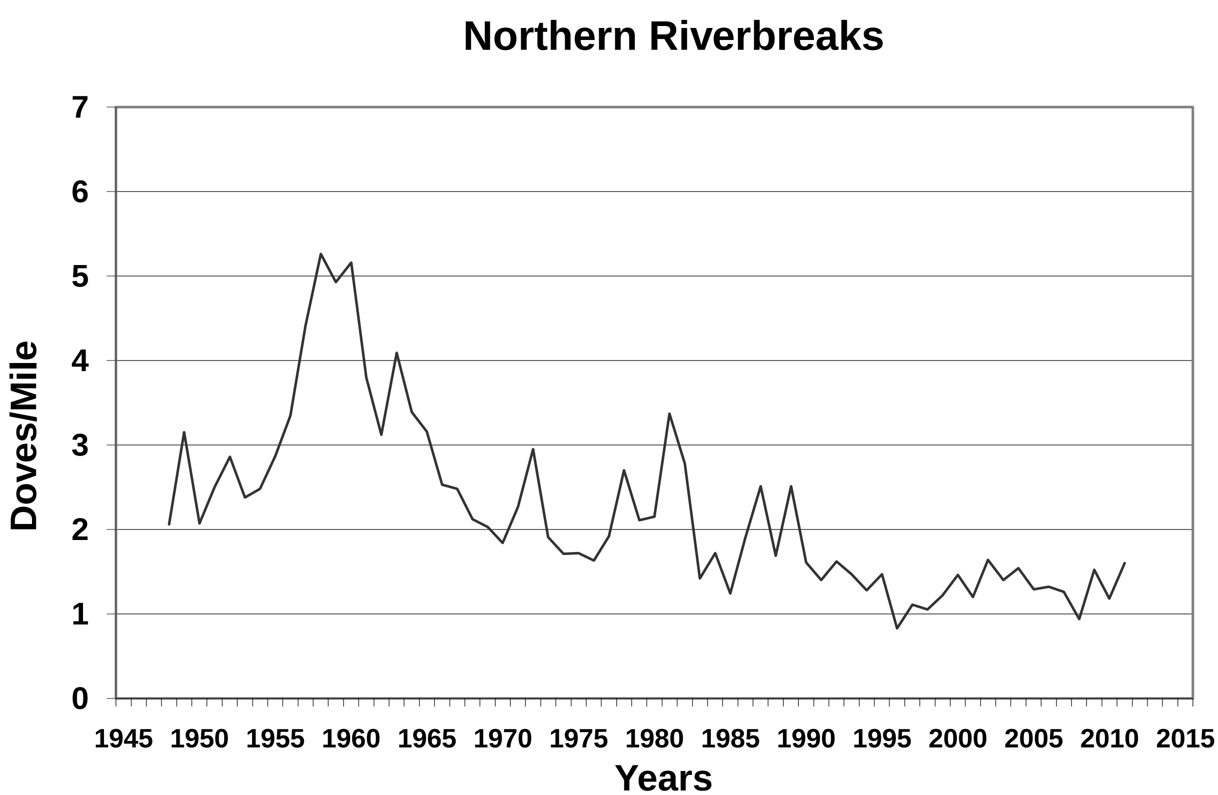

Figure 19. Northern Riverbreaks Zoogeographic Region.

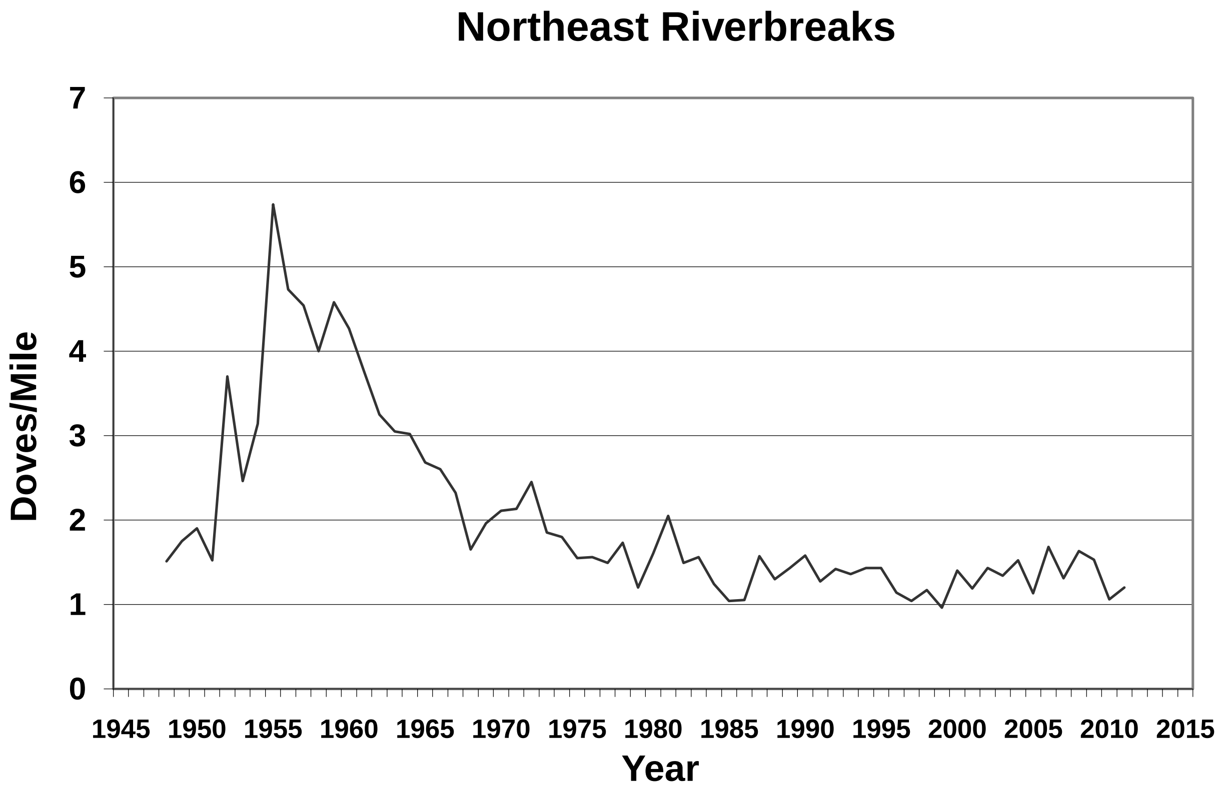

Figure 20. Northeast Riverbreaks Zoogeographic Region.

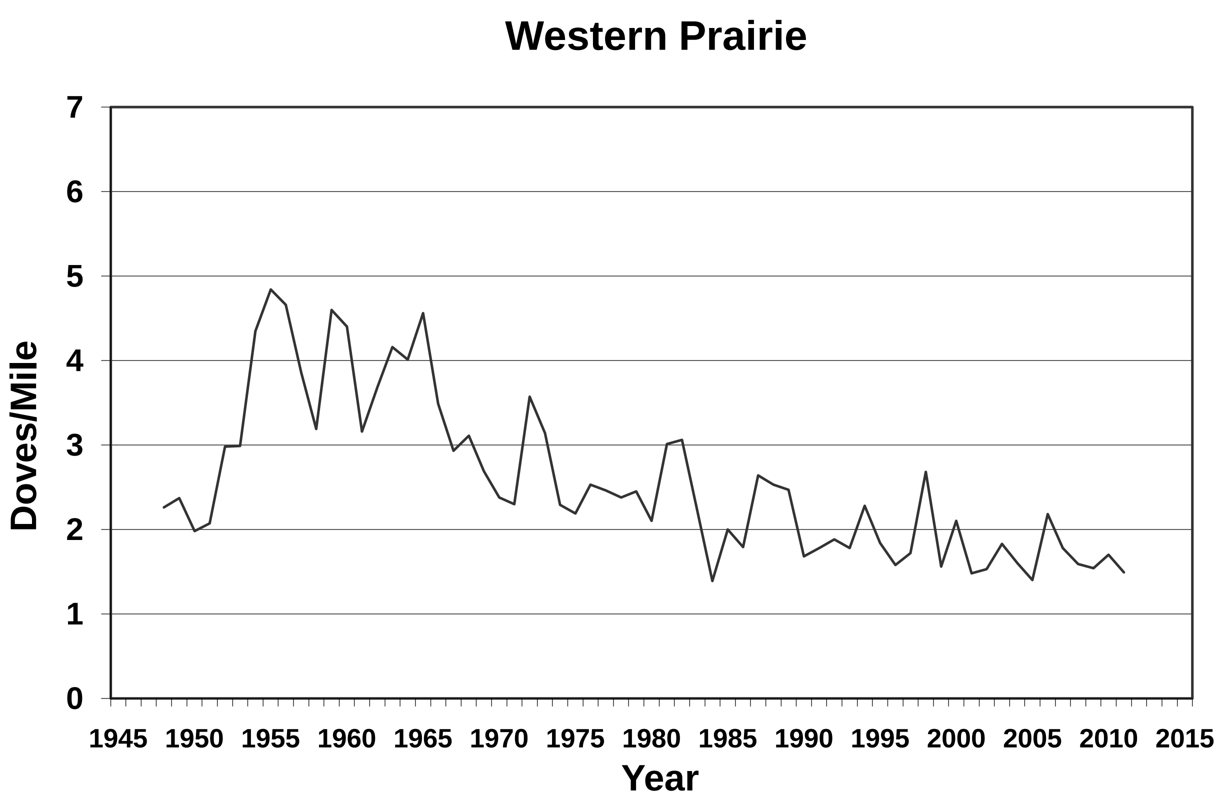

Figure 21. Western Prairie Zoogeographic Region.

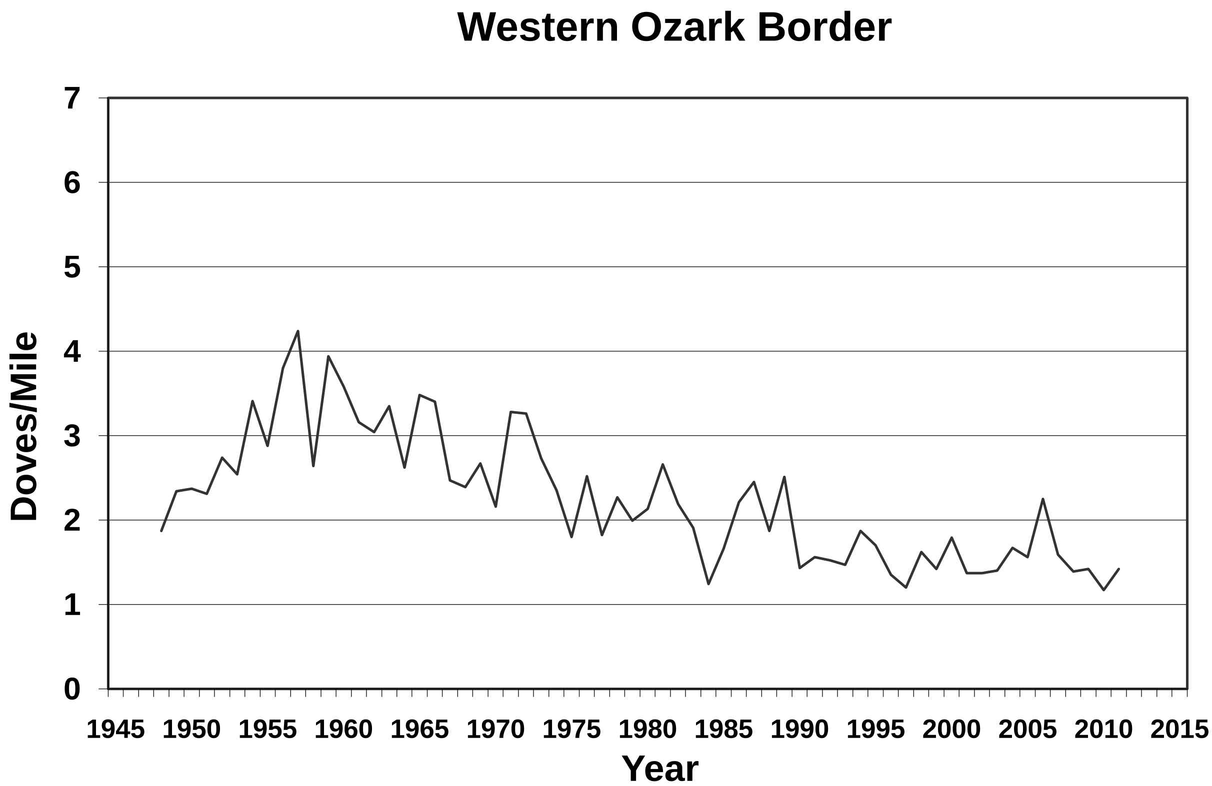

Figure 22. Western Ozark Border Zoogeographic Region.

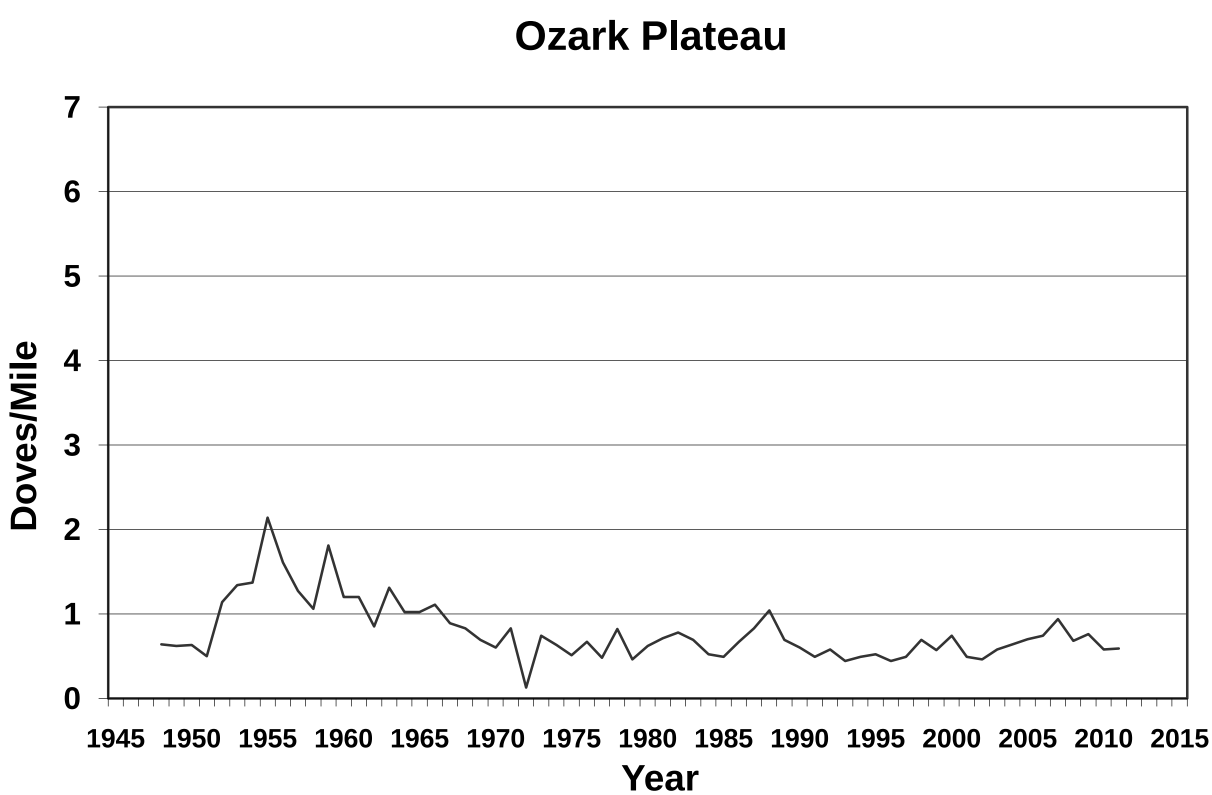

Figure 23. Ozark Plateau Zoogeographic Region.

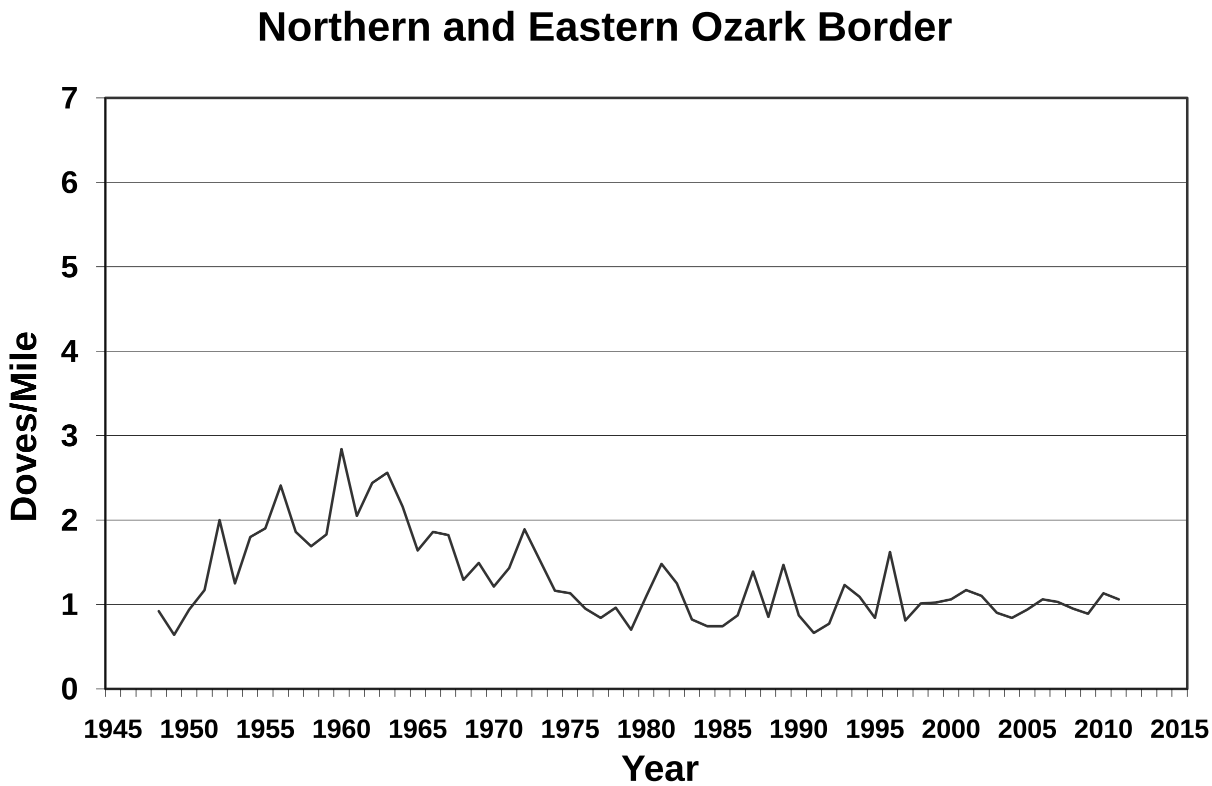

Figure 24. Northern and Eastern Ozark Border Zoogeographic Region.

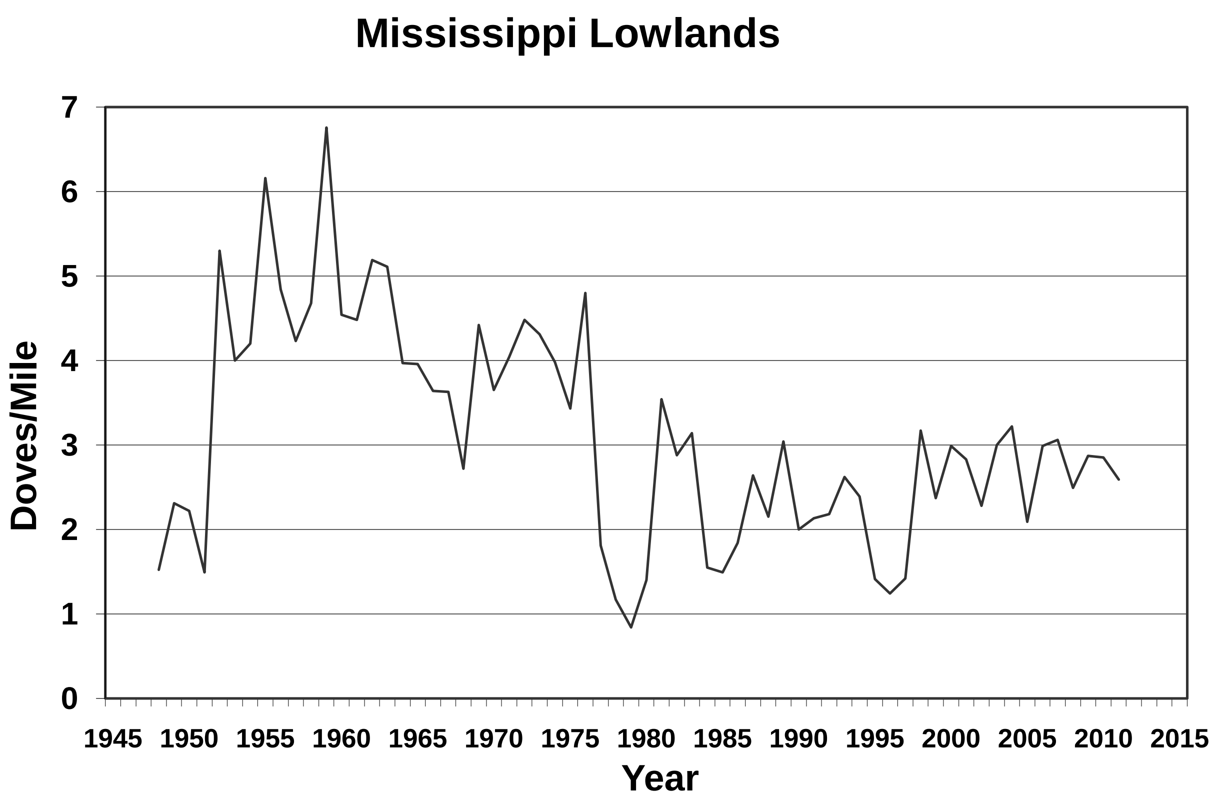

Figure 25. Mississippi Lowlands Zoogeographic Region.

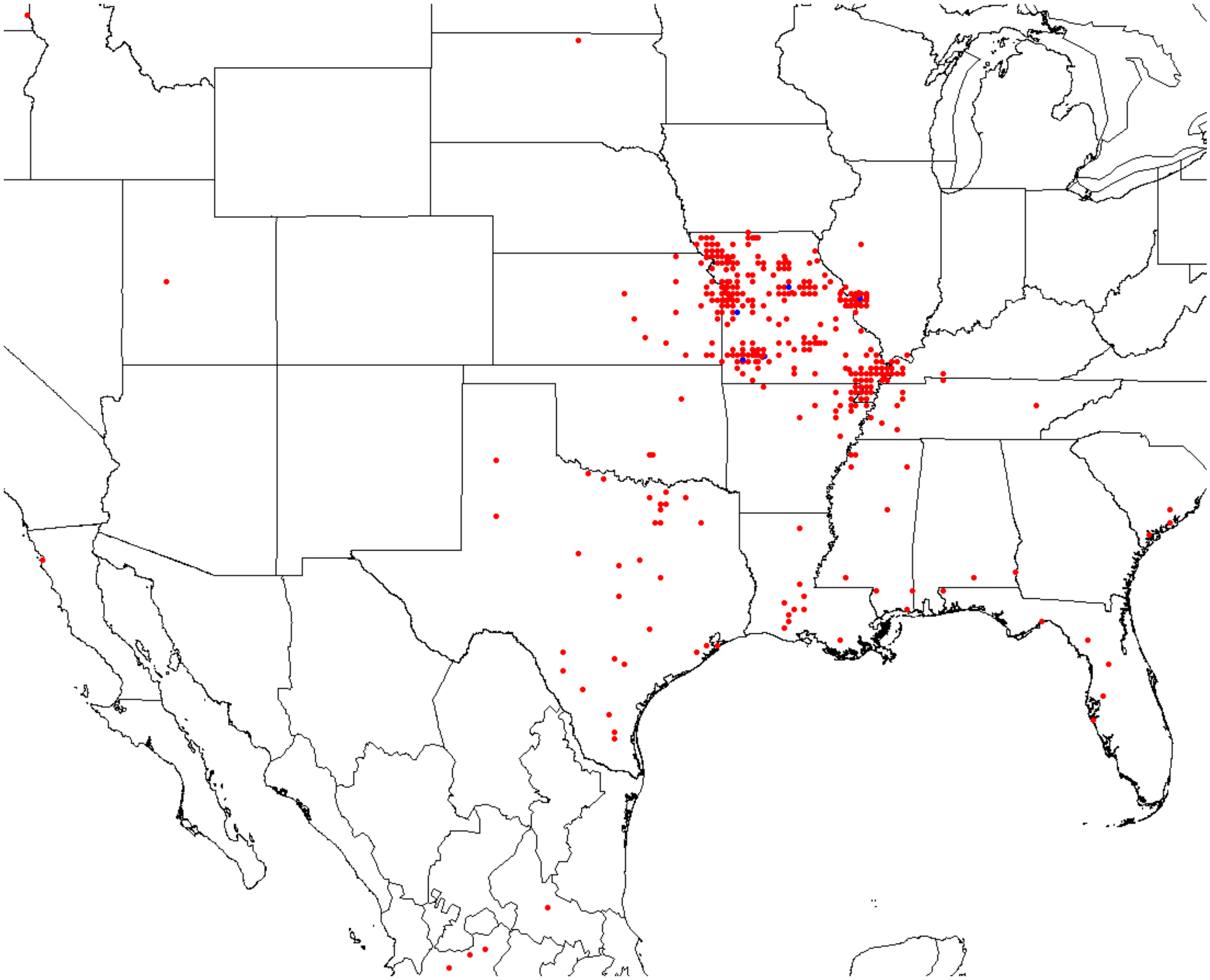

Figure 26. All recoveries for mourning doves banded in Missouri during the period 2003–2010. Red dots for recovery locations and blue dots for banding locations; some blue banding locations are covered with red recovery dots. Note the recoveries in northwestern Idaho, Utah, the Baja Peninsula, Mexico City area, Florida coast, and coastal South Carolina.

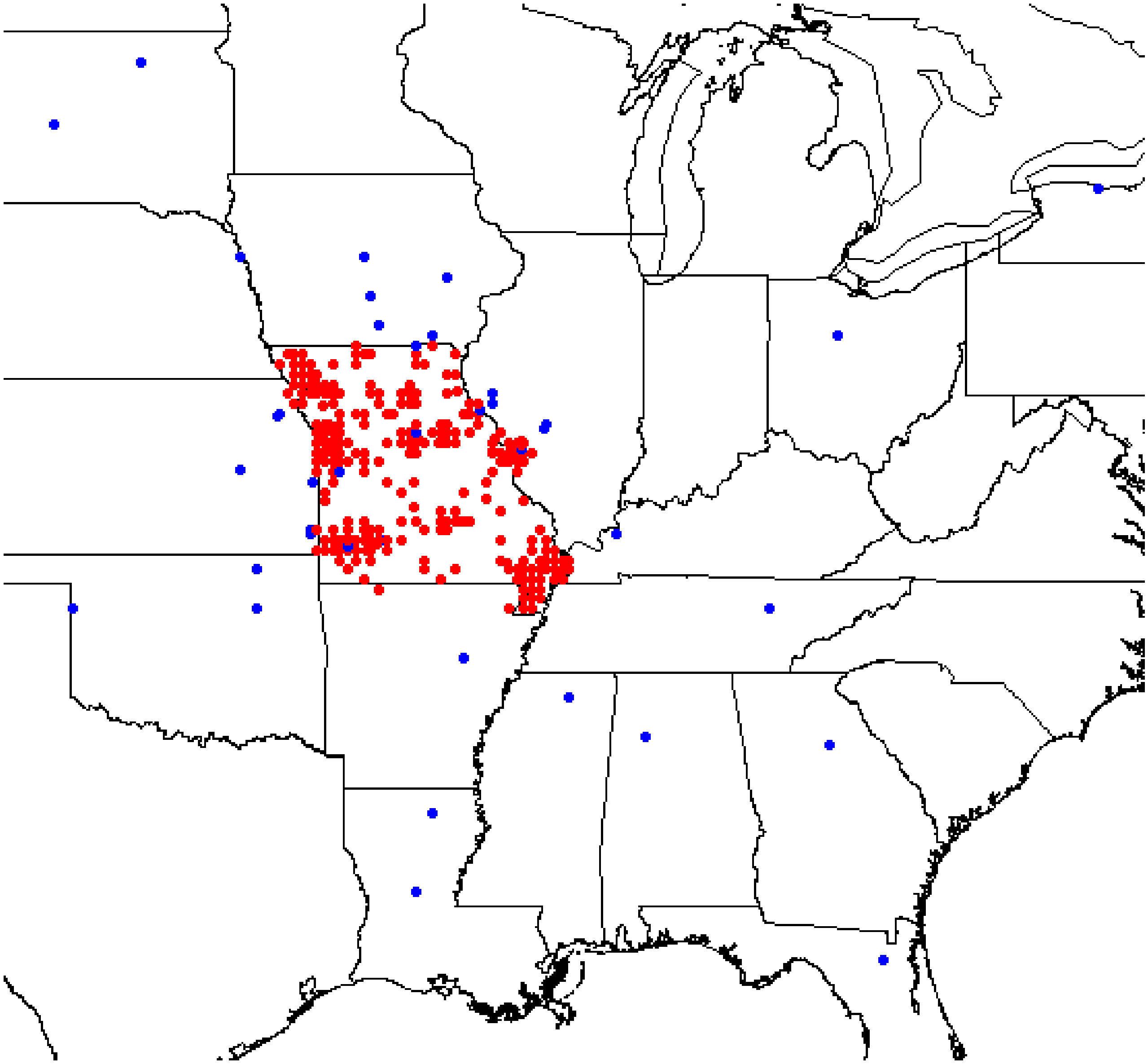

Figure 27. Recoveries only in Missouri of mourning doves banded in Missouri and elsewhere during 2003-2010. Red dots for recovery locations and blue dots for banding locations; some blue banding locations are covered with red recovery dots. Note the blue banding stations in western New York, northern Florida, and northeastern South Dakota.